OVEMBER
1961

ICE 75 CENTS

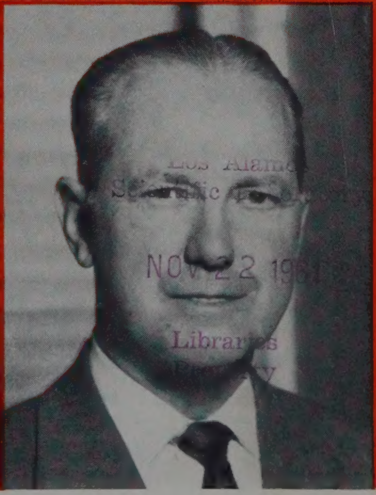
ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING

Electric heat cables bar snow from New York bus terminal ramps. page 73

Underground circuits serve 240-volt multiple M-V street lighting installation. page 80

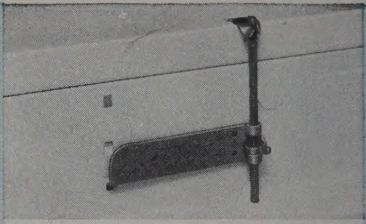
Harold A. Webster, New York, re-elected president of NECA at Washington convention.



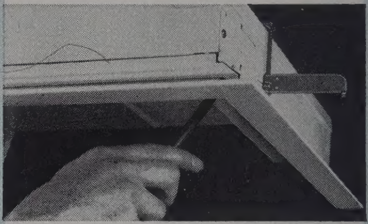
Los Alam
Scientific
NOV 22 1961
Libraries

A McGRAW-HILL PUBLICATION | 61ST YEAR

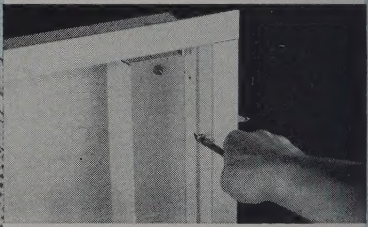
GUTH saves up to 53% on Troffer installation*



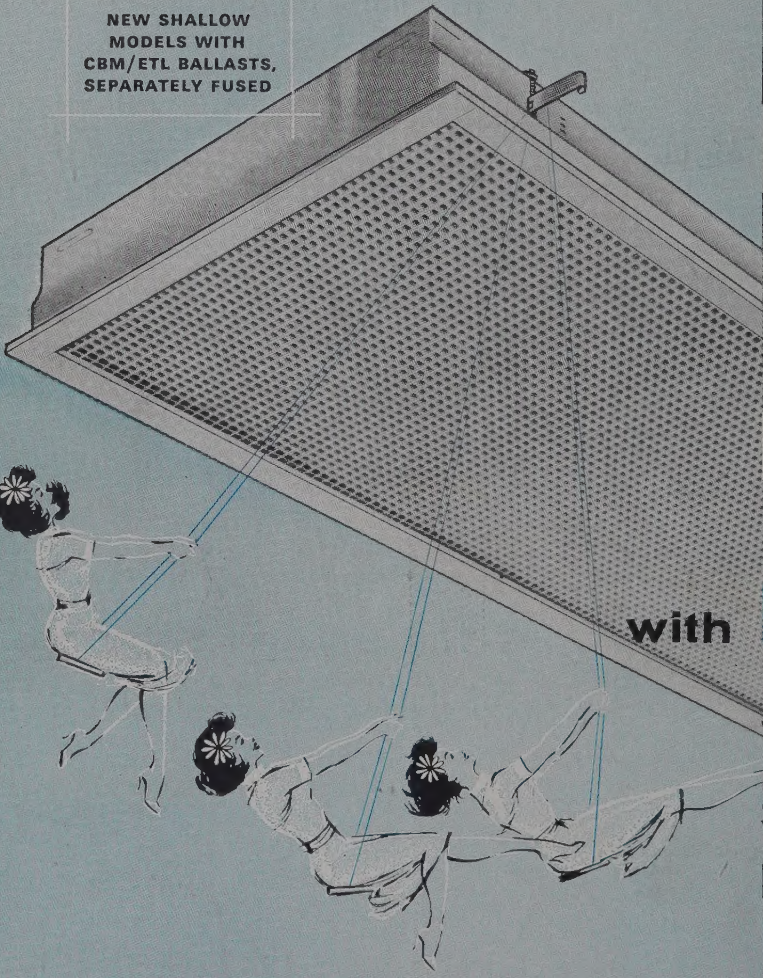
Swing Mounting Bracket is preset for height of ceiling support members by adjusting single screw.



Release SMB by tripping clip from inside troffer. It's ready to hook over support.



Adjust screw to draw up troffer trim flush with ceiling. The job is done!



NEW SHALLOW
MODELS WITH
CBM/ETL BALLASTS,
SEPARATELY FUSED

with NEW SMB swing mounting brackets

New Guth Troffers feature Swing Mounting Brackets to simplify installation...**plus** a complete variety to fit most every specification requirement!

New 4¾" shallow models come in 2' and 4' widths. Other units in 6" and 12" widths . . . 2', 4' and 8' lengths. Almost any bottom you can name — including GrateLite Louver Diffuser** and Prismoid GrateLite†. Adaptable to nearly every type of ceiling suspension system.

*These savings do not include wiring and final connections and are based on installation in a plaster or concealed suspension system.

ASK FOR GUTH SMB TROFFER BULLETINS!

THE EDWIN F. GUTH CO. 2615 WASHINGTON BLVD. • BOX 7079, ST. LOUIS 77, MO.

**® U. S. PAT. NO. 2,745,001 CAN. PAT. NO. 538,245 †® U. S. PAT. NO. 2,904,673

Guth
LIGHTING
since 1902

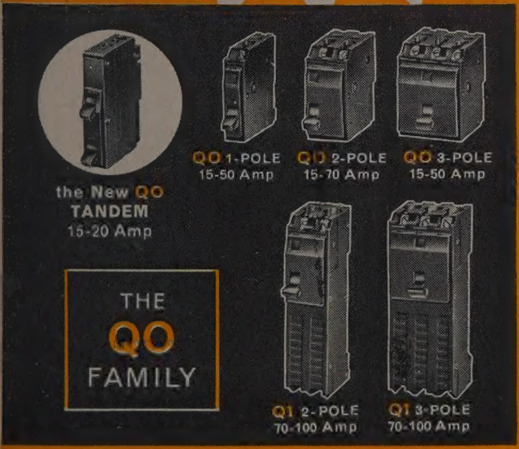
HERE'S THE big NEWS IN CIRCUIT BREAKERS!

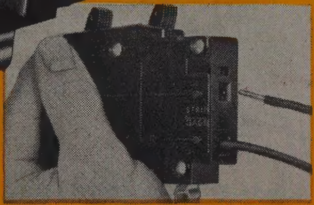
Square D's
New QO Tandem
combines
Two Full Size Breakers
IN ONE
SPACE-SAVING UNIT!

•

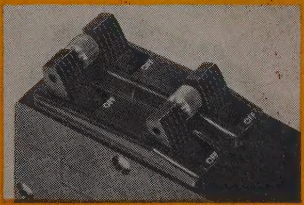
Still Maintains
ALL the QO Features
PLUS
these NEW ONES!

Why settle for half-size breakers? With the QO Tandem it's no longer necessary to sacrifice quality to save space and money

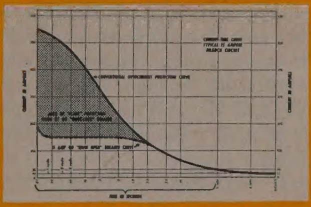




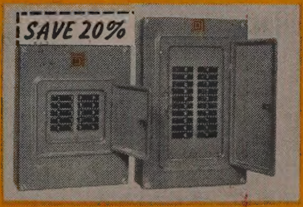
NEW AND EXCLUSIVE *PUSH-IN* CONNECTORS
Fast, positive connections. Holds on 5000 amp shorts.



***DOUBLE* DOUBLE POLES**
Doubles the number of 15 and 20 amp double-pole breakers. Uses QO handle tie.



***QWIK-OPEN* THERMAL-MAGNETIC**
Magnetic opens on first flash. Thermal holds on overloads. No known protection is faster.



SAVES SPACE AND MONEY
More circuits in same space. Lower device cost. Save up to 20%.

Write for latest QO Bulletin which tells the complete story of the finest breaker ever built
Address Square D Company, Mercer Road, Lexington, Kentucky

SQUARE D COMPANY

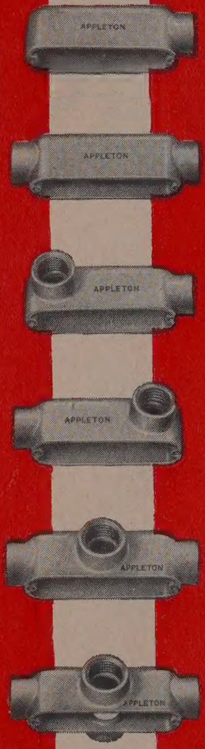
wherever electricity is distributed and controlled

new APPLETON®

"low copper"

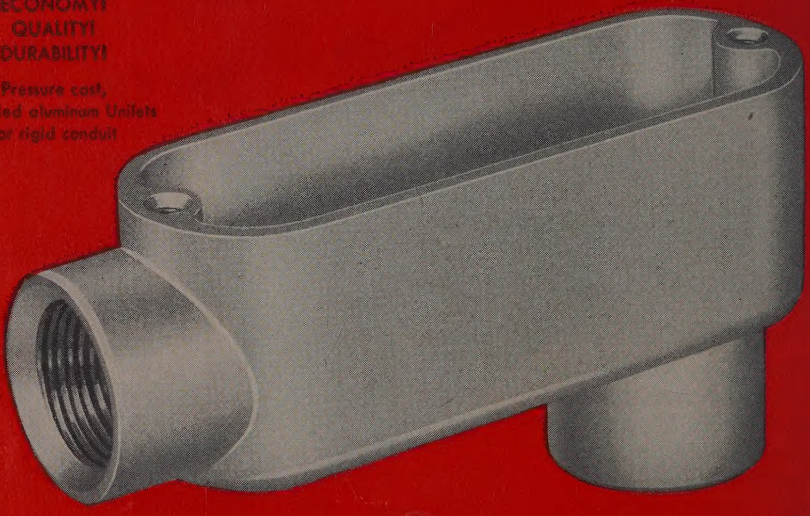
Aluminum Unilets

as copper free . . . as aluminum should be*



ECONOMY!
QUALITY!
DURABILITY!

Pressure cast, threaded aluminum Unilets for rigid conduit



*less than 1% copper content

Form 85 Unilets

The advantages of aluminum combined with Appleton manufacturing standards for dependable performance now make available a wide selection of rugged, serviceable pressure cast aluminum fittings to give you easier electrical installations . . . faster, more economical!

Your distributor has them now. The complete line includes seven of the most popular types in ½", ¾" and 1" sizes to meet most job requirements. When you use them, you will agree . . . they are outstanding in every respect—from design to manufacturing excellence.

BEFORE YOU BUY OR SPECIFY . . . CHECK THESE APPLETON QUALITY FEATURES

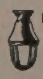
Easy to use—roomy • Lightweight—durable • Taper Tapped threading • Precision hub alignment • Chamfered hub edges • Pressure cast smoothness • Reinforced points of stress • Easy-to-read cast identification • Attractive, practical design • Low cost—high quality • Wide assortment of covers available.

Contact your distributor or write for bulletin No. AL 60. It includes details for the entire *aluminum* product line by Appleton: Form 85 and larger sizes in Form 35 Unilets, FS and JB fittings and V-51 lighting fixtures.

Sold through franchised distributors only

APPLETON®
electric company

Also manufacturers of:


Explosion-Proof Lighting Fixtures

Industrial Lighting

Automatic Reelites

Outlet Boxes, Covers, Switch Boxes

1701 Wellington Avenue, Chicago 13, Illinois

ELECTRICAL CONSTRUCTION AND MAINTENANCE

with which is consolidated Electrical Contracting, The Electragist and Electrical Record . . . Established 1901

Published for electrical contractors, electrical departments in industry, engineers consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management in the field of electrical construction and maintenance.

61ST YEAR • NOVEMBER 1961

Sidelights 7

Washington Report 9

Fallout Shelters, *An Editorial* 71

Bus Terminal Uses Electric Cables for Snow Removal 73
By J. F. McPARTLAND—Design and construction of an electric heating cable system for snow removal from vehicle ramps at New York City's expanded Port Authority Bus Terminal.

NECA Contractors at Washington Convention 77
Personality roundup from the 60th annual meeting of the National Electrical Contractors Association.

Parallel 240-Volt Street Lighting 80
Improved M-V luminaires with built-in constant wattage regulator ballasts connected in parallel on 240-volt underground circuits gave higher lighting levels at lower installation, operating and maintenance costs on over 50 recently completed projects.

Electrical Highlights of a Modern Machine Shop 86
By J. H. WATT—Completely flexible power distribution and high-intensity lighting head a host of design and installation techniques in a new machine shop.

Safety in Electrical Systems 90
By A. L. DOWDEN—Minimize the hazards of electrical application in any plant by regular survey of all distribution and utilization facilities to eliminate faulty or unsafe conditions and to assure maximum safety in equipment installation and layout.

Estimating Forum XV 96
By RAY ASHLEY—Complete contracts versus contracts with extras.

MORE

SILICONE NEWS from Dow Corning

Now...Time for the Boys

Electrical Problems No Longer Short Circuit Our Family Fun

Sure, a father should be a pal to his sons . . . and, mine are at the age when they need and appreciate my companionship most. But when you're lucky enough to be employed at an assembly plant that's doubled capacity twice in the past eight years, you've got more than a full time job . . . and family activities frequently have to take a back seat.

During these eight years I've come up through maintenance to Assistant Plant Manager. It started when I suggested we replace certain troublesome motors with silicone insulated units. Then, when we doubled our plant the first time, I suggested we could double our electrical load capacity in the same floor space by using silicone insulated transformers. Just before our last expansion, my boss was made Plant Manager and I moved up to his assistant. He's taught me a lot . . . and I think I've helped him. We're a good team. And, for the first time since I started working, I'm finding time to really enjoy my boys. By the way, the car we're restoring is a Model A. No, not a Ford . . . a Dusenberg.

I think my progress is the result of plenty of hard work and a good eye for new and better ways of doing things. One of the most important things I've ever read was an advertisement on Dow Corning silicone insulation for electrical transformers and motors—just as you're doing now. I wrote for more information. Why don't you?

For brochure, "Specify Silicone
Insulation and Save",
Write Dept. 3623.

first in
silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

W. T. STUART, *Editor*
Alice McMullen, *Managing Editor*
Associate Editors
Berlon C. Cooper, *New York*
August Eckel, *Chicago*
J. F. McPartland, *New York*
W. J. Novak, *New York*
Hugh P. Scott, *San Francisco*
John H. Watt, *New York*
Art Editor
L. E. Devendorf
Assistant Editor
R. J. Lawrie
Editorial Assistant
Mary A. Corich
Consulting Editors
Ray Ashley, *Chicago*
R. L. Lloyd, *Washington, D.C.*
B. Z. Segall, *New Orleans*
R. E. Ward, *Nashville*
Douglas Greenwald, *Man., Economic Services*
George B. Bryant, Jr., *Chief Correspondent, Washington Bureau*
John Wilhelm, *Manager, News Bureaus*

W. W. GAREY, *Publisher*

A. L. De Weerdt, *Circulation Manager*
W. C. Carmichael, *Business Manager*
Ann P. Barrett, *Production Manager*

R. A. Hubley, *Advertising Sales Manager*
A. B. Conklin, *New York*
E. P. Gardner, *New York*
A. E. French, Jr., *Philadelphia*
F. J. Seiler, *Cleveland*
J. E. Lange, *Detroit*
H. E. Green, Jr., *Chicago*
R. R. Ream, *Chicago*
John Hernan, *San Francisco*
F. E. Le Beau, *Dallas*
D. O. Hanson, *Houston*
Noel Humphrey, *Los Angeles*
R. H. Powell, *Atlanta*
Scott Hubbard, *Portland*

Member of
AUDIT BUREAU OF CIRCULATIONS and
ASSOCIATED BUSINESS PUBLICATIONS

ELECTRICAL CONSTRUCTION AND MAINTENANCE

NOVEMBER • 1961 *continued*

Electric Heating Forum No. 14 98
Humidity and condensation—VI.

Practical Methods 107
Facilities for a trailer country club; electric heating for hangar door.

Motor Shops 115
Pump-test facilities expand shop service; electric bake oven features hinged top; compact spray booth has equipment variety; test bench has built-in prony brake.

Reader Service 123
Product news announcements; catalog and bulletins.

Reader's Quiz 153
Questions and answers on ballast fuse protection; paralleling magnet wires; commutator troubles; short-circuit calculations.

Questions on the Code 167
Answers to code questions on cold-storage vault wiring; fixtures in Class I Division 2 areas; grounding outlet boxes; fire alarm systems; feeder calculations.

In the News 178

Dates Ahead 202

Vol. 61, No. 11 ELECTRICAL CONSTRUCTION and MAINTENANCE NOVEMBER 1961

Published monthly with an additional issue in September by McGraw-Hill Publishing Company, Inc. James H. McGraw (1860-1948), Founder. Executive, Editorial, Circulation and Advertising Offices: **McGraw-Hill Building, 330 W. 42nd St., New York 36, N.Y.** Printed in Albany, N.Y. **Officers of the Publications Division:** Nelson L. Bond, President; Shelton Fisher, Wallace F. Traendly, Senior Vice Presidents; John R. Callaham, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising Sales; A. R. Venezian, Vice President and Circulation Coordinator, Daniel F. Crowley, Vice President and Controller. **Officers of the Corporation:** Donald C. McGraw, President; Hugh J. Kelly, Harry L. Waddell, Executive Vice Presidents; L. Keith Goodrich, Executive Vice President and Treasurer; John J. Cooke, Vice President and Secretary.

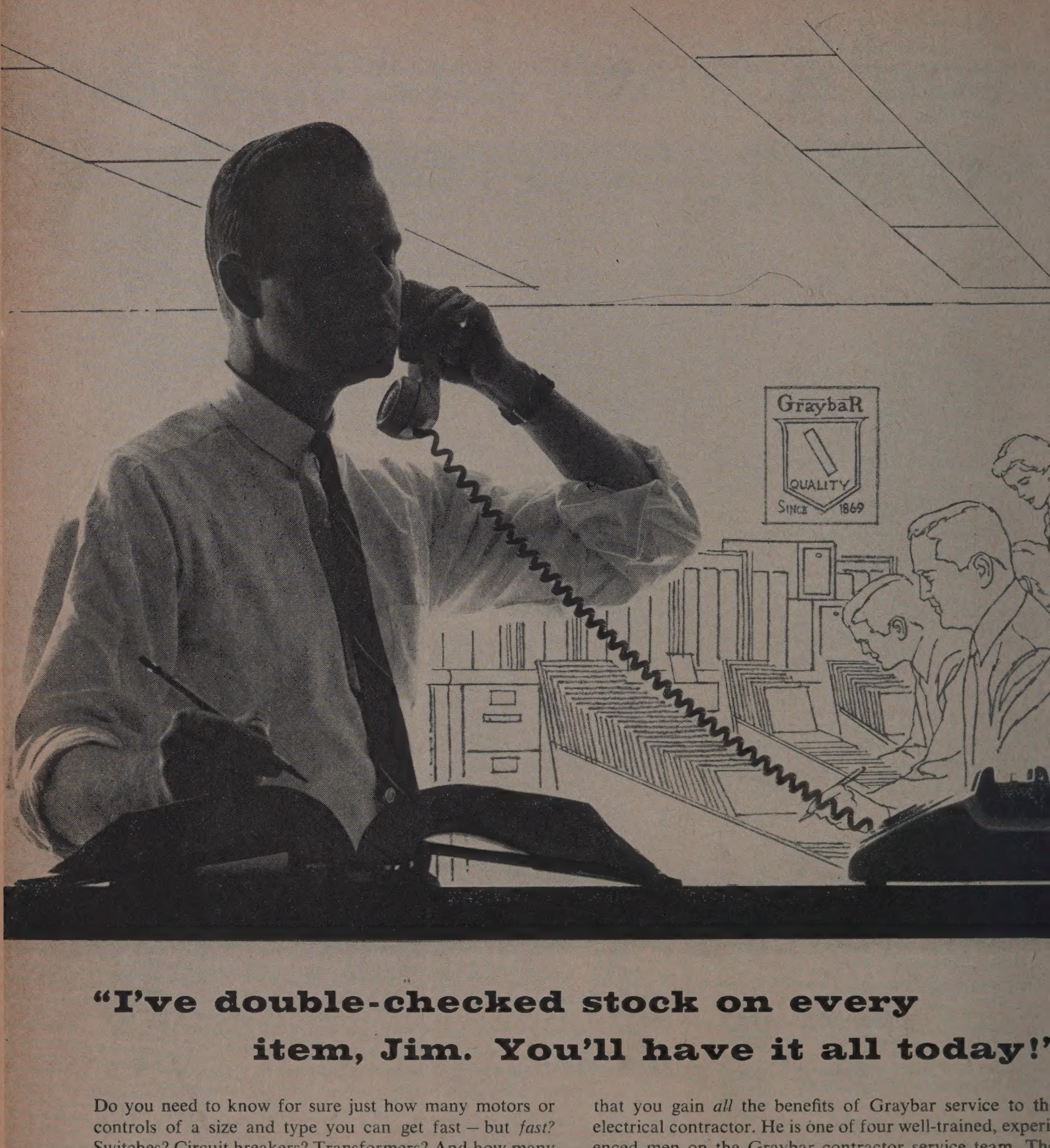
This publication is available only by paid subscriptions which are solicited from persons engaged in electrical construction, maintenance or consulting services. The publisher reserves the right to refuse subscription service to others. **Position and company connection must be indicated on subscription orders.**

United States subscription rate for individuals in the field of the publication $3.00 per year. This issue 75 cents. Electrical Products Guide $2.50. Canada $5.00 a year. All other countries, $15.00 a year, payable in advance. Second class postage paid at Albany, N. Y., and at additional mailing offices. Printed in U.S.A. Title registered in U.S. Patent Office. © Copyrighted 1961 by McGraw-Hill Publishing Co., Inc. — All Rights Reserved.

UNCONDITIONAL GUARANTEE: Subscription service may be discontinued at any time on written request by the subscriber. The publisher will refund the part of the subscription price applying to the remaining unfilled portion of the subscription.

SUBSCRIPTION: Send subscription correspondence and change of address to Subscription Manager, Electrical Construction and Maintenance, 330 West 42nd Street, New York 36, N. Y. Subscribers should notify Subscription Manager promptly of any change of address, giving old as well as new address, and including postal zone number, if any. If possible, enclose an address label from a recent issue of the magazine. Please allow one month for change to become effective.

Postmaster . . . Please send form 3579 to Electrical Construction and Maintenance, 330 West 42nd St., New York 36, N. Y.



"I've double-checked stock on every item, Jim. You'll have it all today!"

Do you need to know for sure just how many motors or controls of a size and type you can get fast — but *fast?* Switches? Circuit breakers? Transformers? And how many feet of conduit or cable?

Within minutes your Graybar Inside Salesman can give you an accurate answer — on any item you need.

Your Graybar Inside Salesman is equally alert to see that you gain *all* the benefits of Graybar service to th electrical contractor. He is one of four well-trained, experienced men on the Graybar contractor service team. Th others: Field Salesman, Counterman, Specialist. The jo of all is to *speed your work . . . reduce your costs . . . hel you build your business.*

Call Graybar today and get this team working for you

Graybar Service includes: Objective recommendations • On-the-job technical help • Most complete lines • Planned stocks to meet your needs • Expert counter service • Speedy handling of will-calls.

GraybaR
ELECTRIC COMPANY, INC

420 LEXINGTON AVENUE, NEW YORK 17, N. Y. • OFFICES IN OVER 130 PRINCIPAL CITIES

Sidelights

SNOW MELTING

One of the largest electric heating cable installations for snow and ice removal in the East has recently been completed at the Port of New York Authority bus terminal in New York City. Vehicle ramps rising from the street level to the various loading and parking levels of the terminal are equipped for electric snow melting with a load density of approximately 40 watts per square foot. The system was installed as part of a $20 million expansion of the terminal facilities. J. F. McPartland reports on the project in "Electric Cables for Snow Removal" beginning on page 73.

STREET LIGHTING

Improved street lighting at lower cost is claimed for a large number of installations using over 1000 luminaires that have been completed and analyzed for cost during the past year in Santa Clara County, Calif. Key to the improvement is the use of mercury vapor lamps with constant voltage regulator ballasts on 240-volt parallel underground circuits. Details of the equipment and methods employed are described in "Parallel 240-Volt Street Lighting" beginning on page 80.

MACHINE SHOP ELECTRICAL DESIGN

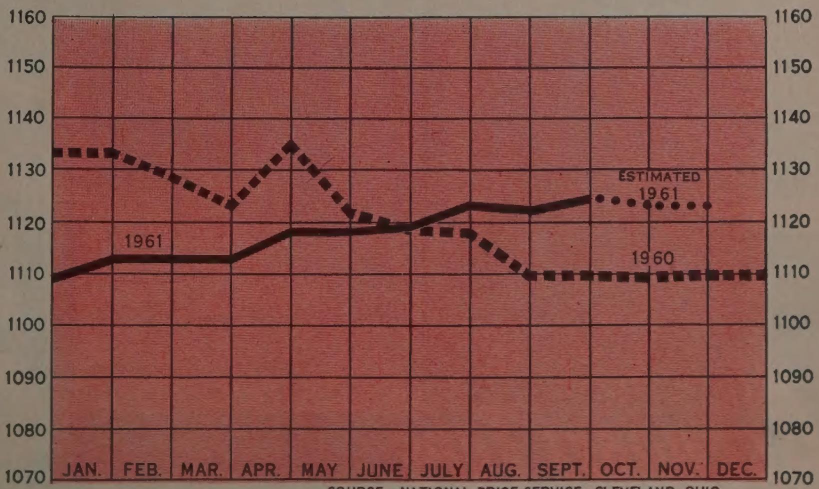
Highly flexible power distribution systems and high-intensity lighting characterizes the modern electrical system design approach for a machine shop. A good example of design and methods is provided by a recent installation by Alex F. Jones Electric Corp., Syracuse, N. Y., for a new 20,000 sq ft facility for the Morris Machine Works at Baldwinsville, N. Y. John H. Watt describes the project in "Electrical Highlights of a Modern Machine Shop" beginning on page 86.

ELECTRICAL SAFETY

Methods and procedures to minimizing electrical hazards in industrial plants must include a regular survey of all distribution and utilization facilities to find and eliminate faulty or unsafe conditions. Alfred L. Dowden, electrical engineer, Liberty Mutual Insurance Co., Boston, Mass., discusses practical checking and inspection schedules in "Safety in Electrical Systems" beginning on page 90.

ELECTRICAL MATERIALS COST INDEX

BASE LINE (1000) REPRESENTS COSTS OF TYPICAL ASSORTMENT OF MATERIALS FOR A SELECTED JOB AS OF NOVEMBER 1, 1951. INDEX POINTS REPRESENT THE VARIATION OF THESE SAME MATERIAL COSTS AS OF THE FIRST OF EACH MONTH.



SOURCE - NATIONAL PRICE SERVICE, CLEVELAND, OHIO

Your Best Buy in Tape . . .
Non-Raveling
Straight Tearing
High Tensile Strength
Strong Adhesion
Highly Insulating
DREVER
Accurate
Friction tape
FRICTION
RUBBER
PLASTIC
FRICTION TAPE
ACCURATE TAPE
ACCURATE MANUFACTURING COMPANY, Garfield, N. J.

Washington Report

NOVEMBER • 1961

Spending by government and business forges ahead at a record rate, but economic growth stumbles along in a rut waiting for a lift from consumer spending. Consumers, however, continue to refuse to increase new spending—while reducing installment debt, and increasing personal savings, as personal income sets new records each month. Retail sales continue to coast along at about $18.2 billion monthly, on a seasonally-adjusted basis. Some pickup should develop in November-December, as new model auto sales and Christmas buying climb to expected new records.

Statistics on economic trends in September "reflect a slowdown in the business upsurge," according to a recent Dept. of Commerce announcement. Included were:

- **Personal income** rose to a seasonally-adjusted annual rate of $420.2 billion.
- **Industrial output** declined to a seasonally adjusted 112% (of 1957 average) from 113% in August.
- **Homebuilding** dropped to 125,300 starts, compared with 129,500 in August.
- **Cost-of-Living** rose to a new record of 128.3% (of 1947-49 average), from 128.0% in August.
- **Construction** spending ran at a seasonally-adjusted annual rate of $58.4 billion, up 1% from August.

New construction spending will probably quadruple over the next four decades, according to a recent study by the Business and Defense Services Administration, Dept. of Commerce. The report, titled "Construction in an Expanding Economy: 1960–2000," indicates that the current dollar volume will approximately double by 1975, and then double again during the last quarter of this century. The dollar volumes are based on 1960 dollars, and the study includes assumptions for other such factors as Gross National Product, population, civilian employment, drop in population per household, etc. Total new construction, which was $55.6 billion in 1960, is forecast at $107.4 billion (93% increase) by 1975, and at $218.7 billion (104% increase over 1975) by the year 2000. The study indicates that public construction will increase to 33% of the total in 2000, compared with 29% in 1960.

September expenditures for new construction increased to a seasonally-adjusted annual rate of $58.4 billion, up 1% from August, and 5% above the September 1960 level.

The September home-building rate was up 3% from August, at a seasonally-adjusted annual rate of 1,360,000 units. This was 25% ahead of the September rate of 1960.

Public and private school construction is expected to total nearly $3.7 billion in 1961, or almost double the dollar volume completed in 1951, ten years earlier. Measured in physical terms, this means almost 70,000 new classrooms were added in the past school year. School bond sales are up 12% over last year, and most of the funds for public school construction come from state and local sources—mostly local.

An international boom in construction is under way, according to some U. S. international contractors. This boom results from industrialization efforts by many new and underdeveloped countries, including hydro-electric plants, highways, irrigation networks. Still a few years away: South American construction arising from the $20 billion U. S.-sponsored "Alliance for Progress" program.

Leviton uses 19 parts and 11 different types of materials to produce this typical switch. Hundreds of special automatic machines are used in fabricating the components. Thousands of skilled operators put the switch through 41 different processes, engineered and controlled every step for maximum accuracy. Only Leviton, with its 3-million sq ft plant facility plus imagination and knowhow, brings you the finest possible switch at the lowest possible price.

LEVITON®

LEVITON MANUFACTURING CO., INC., BROOKLYN 22, N. Y.
Chicago ■ Los Angeles ■ Montreal, Canada

Contact AMERICAN INSULATED WIRE CORP.,
Pawtucket, Rhode Island, A Leviton subsidiary,
for a complete line of insulated wires and cable products.

Catalog #5521
Quiet Switch 20A.277V. A.C. only
Underwriters Laboratories, Inc. Inspected
One of LEVITON's 60 types of switches

1

Bid Kaiser Kingfisher Aluminum for top crew speed (it weighs 1/3 as much as steel, cuts work up to 42%)

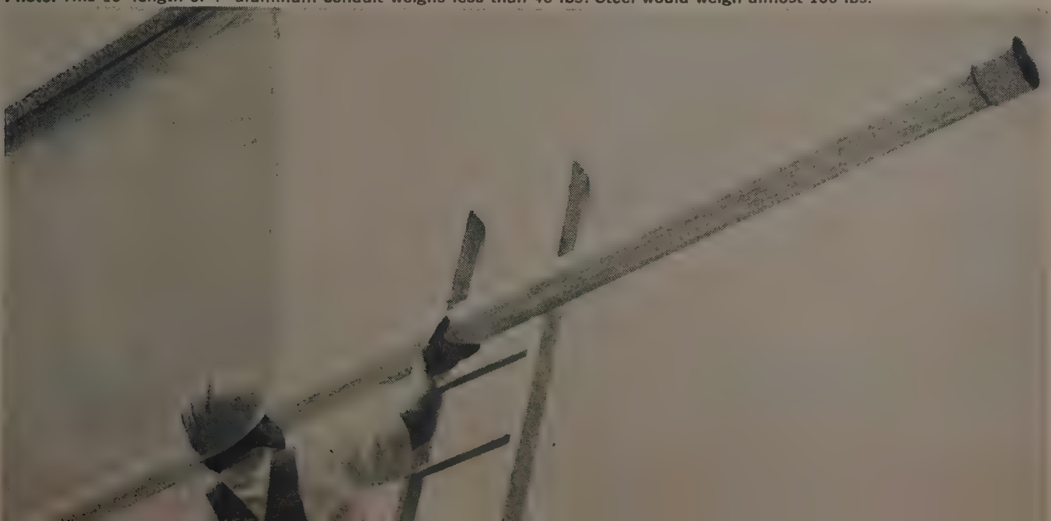
At 10¢ a minute,* why make electricians gang up to hoist heavy conduit? . . . haul it to power benders? . . . lose time cutting through galvanized steel? Kaiser Kingfisher Aluminum conduit—weighing only one-third as much as steel—is easier to haul, cut, thread, bend. Hanging is faster, because runs can be preassembled. You save up to 42% in labor with Kingfisher conduit.

KAISER ALUMINUM
KAISER CENTER, OAKLAND, CALIFORNIA.

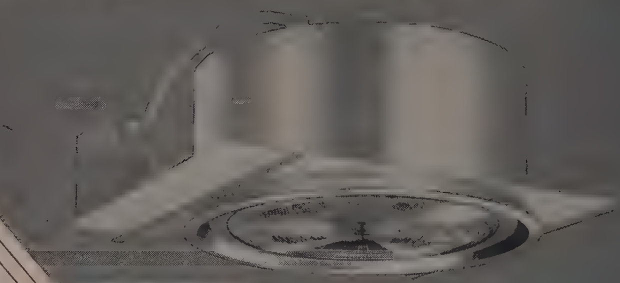
* Typical all-inclusive cost per man.

COMPARISON: 1¼-inch conduit	Galvanized Steel	Kaiser Aluminum Kingfisher
Weight, per 100 ft.	200 lbs.	79.8 lbs.
Cutting	Blade cutter 3 minutes	Saw or wheel cutter 1 minute
Threading time floor to floor	2 minutes	50 seconds
Bending crew	Two men or power bender	One man with hickey
Manhours per 100 feet, service 12′ ceilings	6.5 hours	4.9 hours

Photo: This 10′ length of 4″ aluminum conduit weighs less than 40 lbs. Steel would weigh almost 100 lbs.



in this day of Prismatic Light Control



Art Metal

introduces a new line of Aluminum Recessed and Surface Rounds with Regressed Prismatic Amcolenses*

The prismatic Amcolenses are regressed above the ceiling to lessen glare and provide an architecturally pleasing ceiling surface. Housing and exposed frame are made of aluminum for ultimate dependability, indoors and outdoors, particularly in coastal areas. Write for Bulletin [illegible]

*[illegible]

WAKEFIELD
CORPORATION

ELECTRICAL PRODUCTS GROUP
Art Metal Lighting Division — Cleveland 3, Ohio
1814 East 40th St.
Wakefield Lighting Limited — London, Ontario

Wakefield Lighting Division — Vermilion, Ohio
Sta-Warm Electric Company — Ravenna, Ohio

2

Install Kaiser Kingfisher for trouble-free runs (rust-free aluminum reduces future maintenance)

Aluminum means lasting conduit protection because it won't rust. It also means a safer electrical system, because aluminum conduit walls are highly conductive. The contractor whose business depends on his reputation will find Kaiser Kingfisher the surest way to profitably deliver a professional, lasting conduit system. It will remain trouble-free, reduce future maintenance.

KAISER ALUMINUM
KAISER CENTER, OAKLAND, CALIFORNIA.

CORROSION-RESISTANCE ADVANTAGES OF ALUMINUM

Excellent for burial in concrete.
Interior will not rust.
Less affected by chemical environment than zinc or steel.
Less affected by atmospheric corrosion than zinc or steel.
No rust to stain buildings.

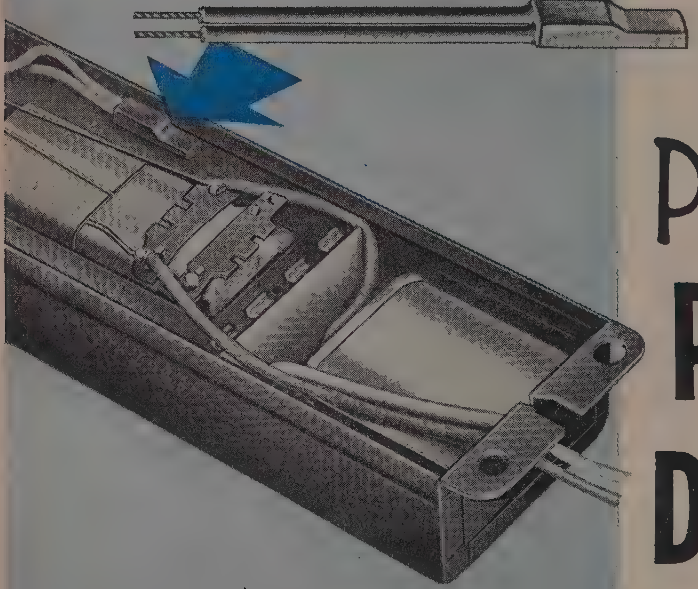
ELECTRICAL ADVANTAGES OF ALUMINUM

Lower voltage drop.
Five times as conductive as steel.
Continuous ground not interrupted by rusted thread connections.
Non-sparking. Approved by NEC for hazardous locations and wherever RIGID metal conduit is required.

Photo: Kaiser Aluminum conduit was chosen for corrosion-resistance in this new mine of Morton Salt Co., in Ohio.

Only ADVAN guard®

AUTOMATIC RE-SETTING THERMOSTAT



Protects against PREMATURE DESTRUCTION

OF FLUORESCENT LAMP BALLASTS . . . AND ELIMINATES THE NEED FOR INDIVIDUAL FUSING.

ADVAN-guard® protects fluorescent lamp ballasts against premature destruction and costly replacement by protecting against abnormal operating temperatures due to incorrect voltage supply, excessive current, lamp rectification, internal ballast short circuiting, inadequate lamp maintenance and improper fixture application.

ADVAN-guard®, a thermally actuated protective thermostat sealed in the ballast housing, automatically 'trips-out' whenever the ballast operates at abnormal temperatures from any internal or external cause. Unlike other protective devices which permit premature ballast destruction by cutting the ballast out of the line only after it has been destroyed, ADVAN-guard® cuts out before heat can cause premature destruction, resets automatically when the trouble has been corrected and permits the ballast to resume normal operation.

Don't settle for one-time protectors that destroy fluorescent lamp ballasts after a single cycle of abnormal temperatures . . . insist on ADVAN-guard® equipped fluorescent lamp ballasts for safety and longer life.

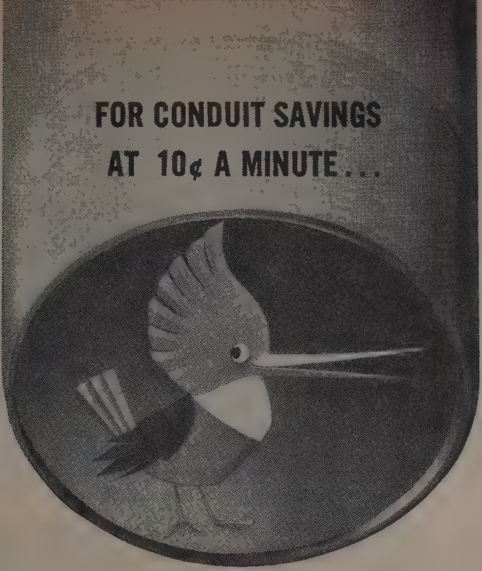
"The Heart of the Lighting Industry"®

Mfg. in Canada by: Advance Transformer Co. Ltd., 5780 Pare St., Montreal, Quebec

ADVANCE® TRANSFORMER CO.

WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF FLUORESCENT LAMP BALLASTS

2950 NO. WESTERN AVE. CHICAGO 18, ILL. U.S.A.



3

Be sure it's Kaiser Kingfisher Prime 6063 Alloy ("pot luck" substitutes can pile up costly labor)

Kaiser Kingfisher conduit is extruded from uniform prime 6063 aluminum conduit alloy. It always has uniform T-42 temper for easy bending . . . full wall thickness . . . uniform threads, lubricated both ends.

As a result, you can standardize each operation. You can work accurately at top speed, with minimum equipment. This is not true of "pot luck" conduit made without quality control. If conduit is too soft, bends collapse. If too hard, work slows. These and other variations of "pot luck" conduit can nickel and dime you to death.

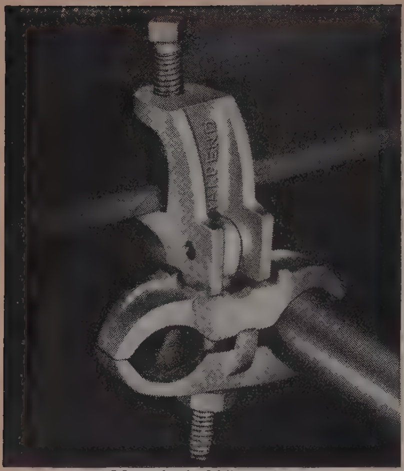
For conduit savings you can rely on, specify Kaiser Kingfisher—prime metal controlled from mine to market by the leading manufacturer of aluminum conduit. It's uniform in every delivery.

Another reason to buy Kaiser Kingfisher— Thread-Saving Forged Couplings

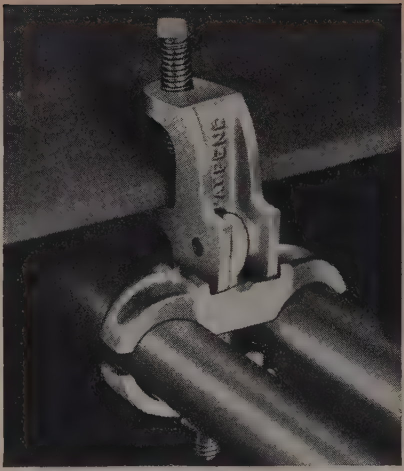
Only Kaiser Kingfisher offers forged couplings with its conduit. The stronger threads of these couplings will chase damaged threads—save hours of rethreading.

KAISER ALUMINUM
KAISER CENTER, OAKLAND, CALIFORNIA.

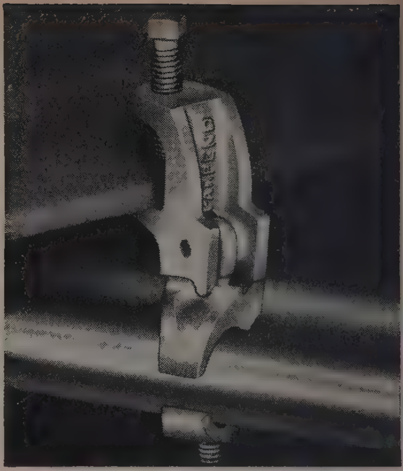
Photo: All Kingfiisher conduit is extruded prime 6063 alloy. One man accurately bends up to 1½-inch size. No springback.



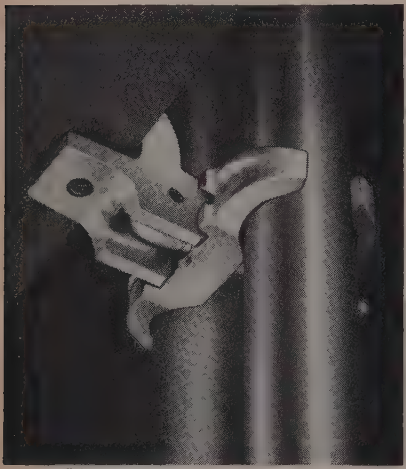
90°—single ½" conduit



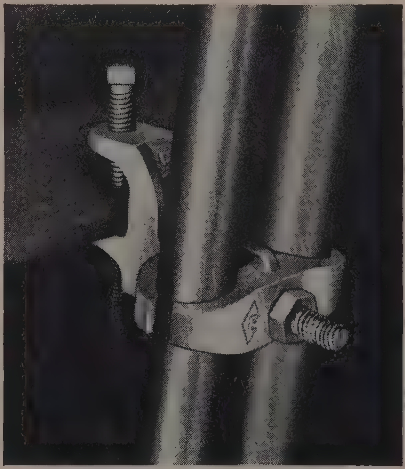
90°—combination ½" & ¾" conduit



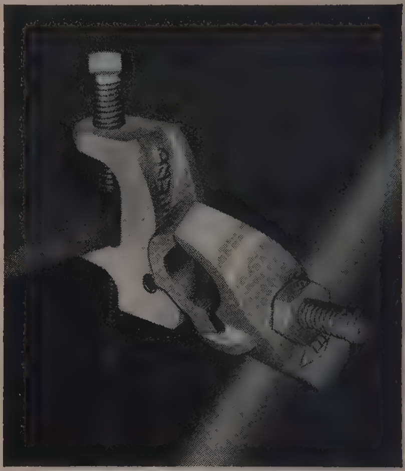
45°—combination ¾" EMT & conduit



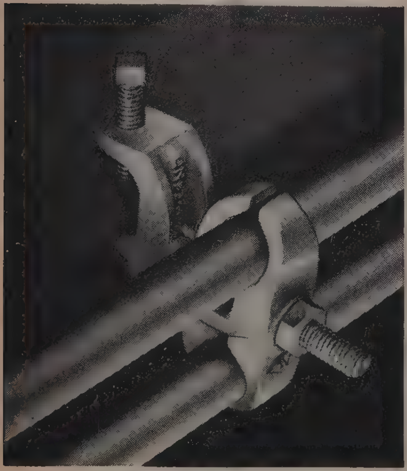
Edge—showing ¼-20 tapped hole



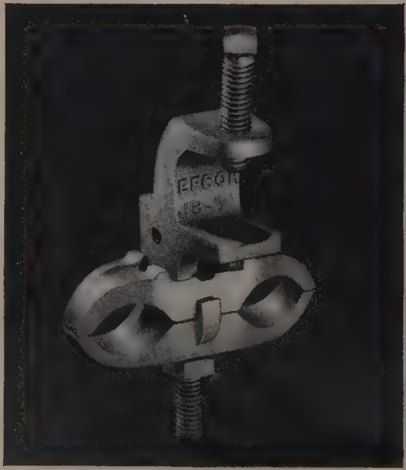
Edge—showing use with ¼-20 rod



Edge—45°—single ½" conduit



Parallel—2—½" EMT



Cat. No. JB-50

Make all these
installations
with just
a single new
EFCOR ALLWAY*
Beam Clamp

Soon available for 1" & 1¼", 1½" & 2"

Most versatile beam clamp ever designed! Each clamp holds either one or two conduits—each conduit grip takes two sizes! Clamping section can be swiveled to any plane, all angles—becomes a 90°, edge or parallel clamp... whatever the installation calls for. No need to stock a variety of types . . . you never run short of the clamp you need. One EFCOR ALLWAY Beam Clamp does it all. And gives you the greatest combination of economy and on-the-job convenience! Write for literature:

Efcor

ELECTRICAL FITTINGS CORPORATION, EAST FARMINGDALE, NEW YORK

*pat. pend.

4

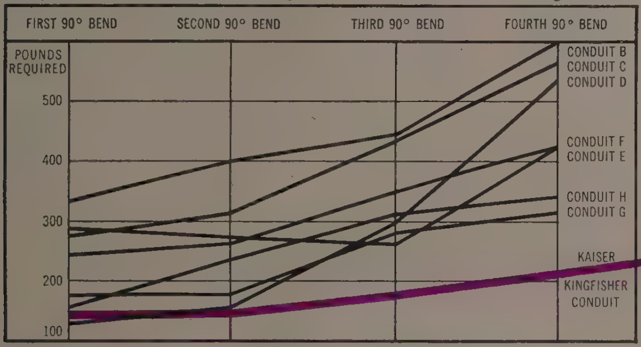
Get a dividend in Kingfisher K-40 Silicone Lining (lets cables slip through with up to 61% less pull!)

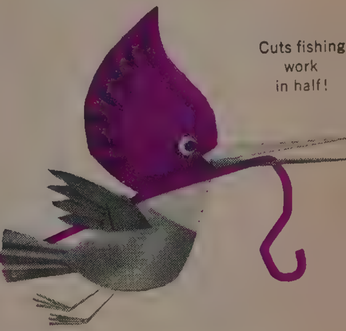
Get Kaiser Aluminum and K-40 too! This amazing all new silicone lining—exclusive in Kaiser Kingfisher conduit—has been laboratory tested against other types of linings. As shown in the chart below, slick K-40 beats them all. It required 2.5% less pull than galvanized steel at the second 90° bend, 39% less at the third, 61% less pull at the fourth bend. A big difference in labor!

To be sure of all the savings of Kaiser Aluminum conduit—plus exclusive K-40 silicone lining and forged couplings—specify Kaiser "Kingfisher" by name.

POUNDS OF PULL REQUIRED—ALUMINUM AND GALVANIZED STEEL CONDUIT

Test pulls of three fresh #2 RHW through 1¼-inch conduit with various lining materials.




Cuts fishing work in half!

BE SURE IT'S KAISER ALUMINUM

KINGFISHER

RIGID ALUMINUM CONDUIT WITH K-40 SILICONE LINING

STOCKS NOW THROUGHOUT THE COUNTRY AT LEADING DISTRIBUTORS.

KAISER ALUMINUM

KAISER ALUMINUM AND CHEMICAL CORP., KAISER CENTER, OAKLAND, CALIFORNIA.
See FOLLOW THE SUN and MAVERICK weekly, ABC-TV Network.

What's your problem? If you can solve it with a

New Cutler-Hammer operator options provide top flexibility...
world's best oiltight limit switch

For any use, anywhere, in any position . . . you just can't buy a more reliable, longer-life switch. No other switch is sealed more effectively . . . effectiveness we've proved under test conditions so rugged they will never be equaled in actual service. Even the silver-to-silver contacts are visible for quick inspection. For full details on this complete new line, write for Pub. ED-145-W241.

For any electrical control problem, contact your local Cutler-Hammer sales office or distributor. They'll supply you with the finest electrical components, the finest service and technical help.

Many operator options, many special new features, including four position operator head

limit switch, your best answer's here!

WHAT'S NEW? ASK...

CUTLER-HAMMER

CONTROL

Cutler-Hammer Inc., Milwaukee, Wisconsin • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C. A. • Associates: Cutler-Hammer Canada, Ltd.; Cutler-Hammer Mexicana, S. A.

Floodlight test equipment.

It shouldn't be, of course. But it is.

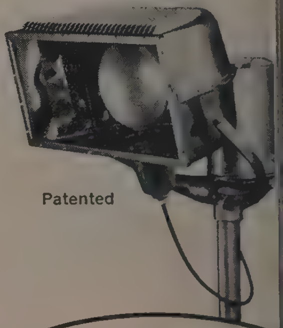
Unfortunately, when you put a floodlight up on a pole, somebody is going to try to find out how much punishment it can take. That's one of the reasons we build Wide-Lites the way we do.

The tempered glass lens, for instance, does more than keep dust, dirt and moisture away from the reflector. It also *protects* the lamp and reflector from everything but the best-armed vandal. Strong enough to withstand hammer blows, the Wide-Lite lens can shrug off the average BB shot and most objects that can be thrown to floodlight height. (Rear-guard protection for the reflector is taken care of by the rugged die-cast aluminum Wide-Lite body.)

A hot floodlight lamp should be protected from *nature's* vandalism, too—from the sudden shock of ice cold rain and sleet. Naturally the Wide-Lite tempered glass lens resists such thermal shock. Resists it so well, in fact, that no Wide-Lite lens has ever cracked or broken from thermal shock.

In short, the Wide-Lite lens is built to stay put. Even when relamping. (A special access plate makes it easy to relamp without disturbing the lens seal.)

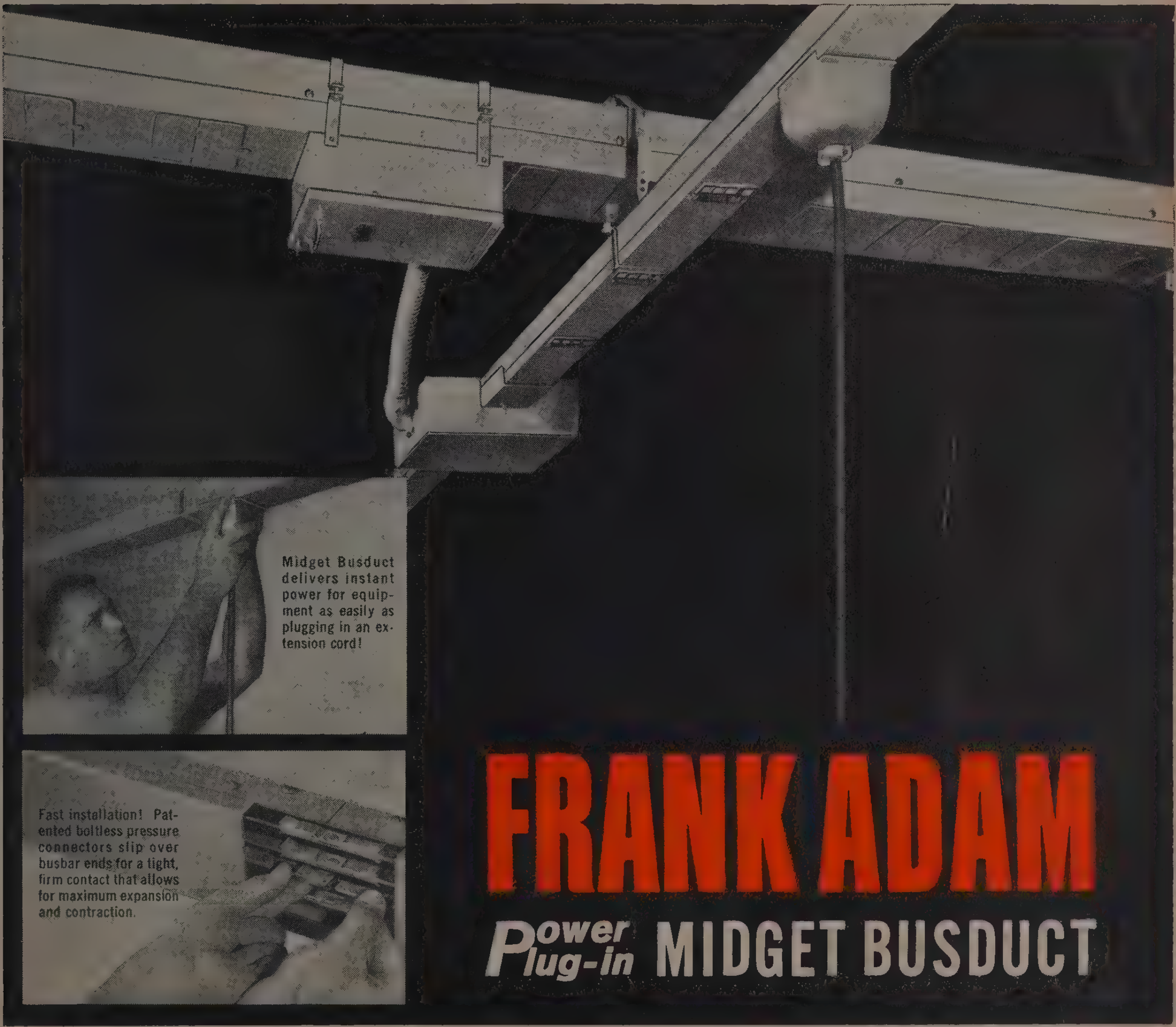
Why not find out all the other things that make Wide-Lites so provably better? Write today for more facts. Wide-Lite Corporation, Division of Esquire, Inc., Dept. VA-1, 4114 Gulf Freeway, Houston 1, Texas.



WIDE-LITE

HIGH EFFICIENC
FLOODLIGHTS

EXTEND ANY PRESENT BUSDUCT SYSTEM TO ANY SPOT IN THE PLANT FOR LESS THAN THE COST OF WIRE & CABLE!



Midget Busduct delivers instant power for equipment as easily as plugging in an extension cord!

Fast installation! Patented boltless pressure connectors slip over busbar ends for a tight, firm contact that allows for maximum expansion and contraction.

CHOOSE FROM THREE TYPES OF PLUG-IN UNITS

★ CIRCUIT BREAKER UNIT

FUSIBLE PLUG-IN (Non-operating) UNIT ★

★ FUSIBLE PULL-OUT (Operating) UNIT

100-Amp. plug-in power fed from existing busduct to any location with MIDGET BUSDUCT

Although the initial price of Midget Busduct is slightly more than wire and cable, the saving on labor alone results in a surprisingly lower installed cost.

No cutting or bending, no threading of conduit is necessary with Midget Busduct. It is 100% salvageable when plant layouts are changed, or machine relocations are made. Quick availability of plug-in units permits load connections in minutes to save even more on labor.

Either copper or aluminum conductors can be furnished. Midget Busduct has plug-in outlets every 10″, on one or both sides, to accommodate three types of plug-in units, shown at left, in 30 to 100 amp. capacity. *Ask for complete information and prices.*

FRANK ADAM ELECTRIC COMPANY
SINCE 1891
P O BOX 357, MAIN P. O. • ST. LOUIS 66, MO

KEEP PACE ELECTRICALLY

PRODUCERS' COUNCIL

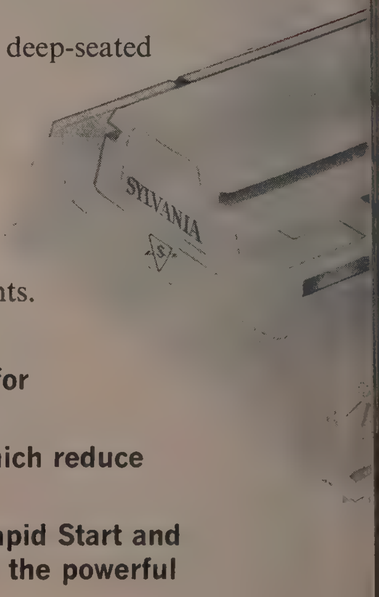
busduct • panelboards • switchboards • service equipment • safety switches • load centers • Quikheter

The Ideal Answer to Your Industrial Lighting Problems... Sylvania's N

Here is a totally-new series of industrial lighting fixtures designed to make your lighting fixture selection simple and positive.

Sylvania's Power-V Series includes *all of the features you want* in industrial lighting equipment—ruggedness, versatility, adaptability, ease of installation and maintenance, trimness, simplicity, high efficiency, excellent lighting characteristics . . . and all at competitive prices.

This is a completely modern fixture series from the deep-seated channel design to the wide, rugged embossed reflector.



The Power-V Series is designed to provide the high level, quality lighting job you need to increase production and efficiency and to decrease rejects and accidents. Because of the wide choice of models and lamp types, you can practically custom-design a lighting system to fit your exact illumination requirements.

Each Power-V model features:

- **Reflectors with deep embossments and ribbing for strength and rigidity.**
- **Simplicity of design and labor-saving devices which reduce installation and maintenance time.**
- **Excellent lighting characteristics with 430 ma Rapid Start and Instant Start; 800 ma Rapid Start; or any size of the powerful 1500 ma Rapid Start lamps.**
- **A low silhouette to provide neat, trim appearance.**

From every angle, we believe the Power-V Series to be the finest line of industrial lighting fixtures ever produced. May we send you the details? Just write to:

SYLVANIA LIGHTING PRODUCTS
A Division of SYLVANIA ELECTRIC PRODUCTS INC.
One 48th Street, Wheeling, West Virginia

For New Construction or Industrial Modernization...
Be Sure to Investigate Sylvania's **Power-V** *Series*

Power-V
Series

POWERFUL

Recommended footcandle levels are reached easily with Power-V . . . and you maintain quality standards, too. Designed to use 430 ma, 800 ma or all types of 1500 ma lamps.

RUGGED

Strong, rigid fixtures featuring double V embossments in reflector. Withstands rough handling or accidental bumps and abuse.

NEAT

Trim, shallow appearance assured through positive integration of channel and reflector. Low silhouette enhances any installation.

SIMPLE

Clean design, minimum parts, labor-saving devices add up to simplicity of installation and maintenance.

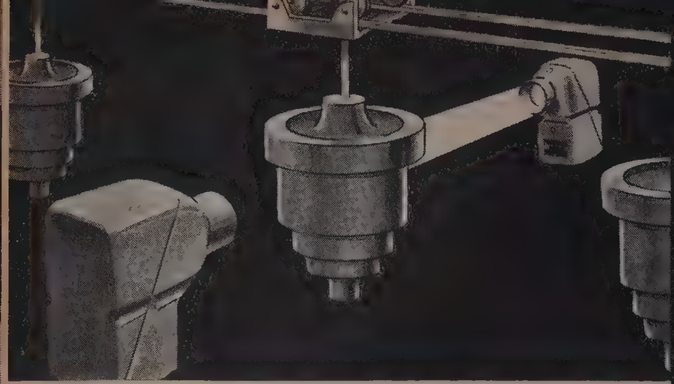
LIGHTING FIXTURES BY

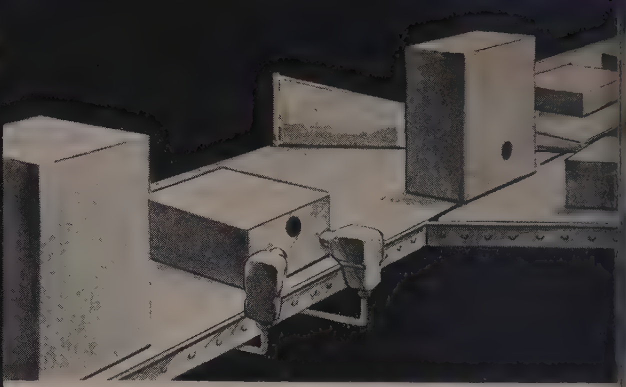
SYLVANIA

SUBSIDIARY OF

GENERAL TELEPHONE & ELECTRONICS

GENERAL SYSTEM





PRODUCTION COUNTING

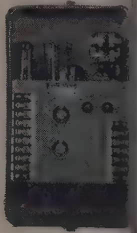
Problem: Stepped-up production rate made it difficult to count units accurately with existing mechanical equipment.

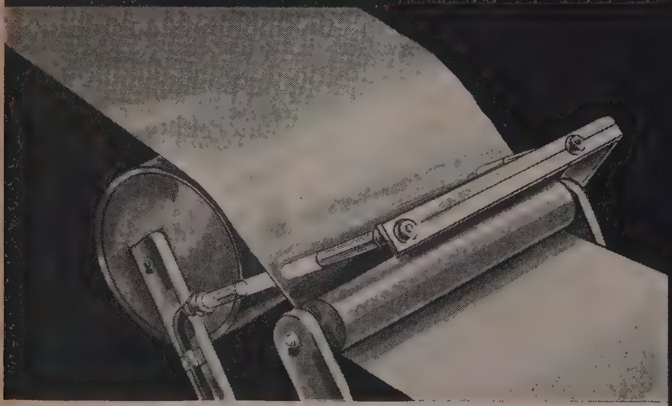
Solution: Plant Electrician installed two low-cost G-E photoelectric units connected to automatic counter. Even though production units come in bursts of over 150 per minute, this simple counting setup now tallies them swiftly and accurately.

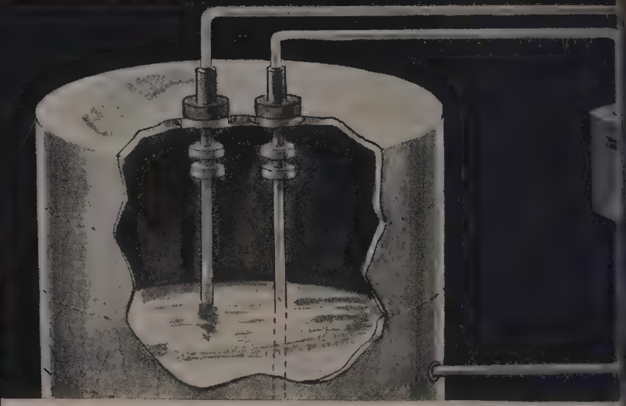
SORTING DISSIMILAR CARTONS

Problem: To automatically divert selected boxes from main conveyor to side conveyor.

Solution: Plant engineer suggested printing black circular marks on those boxes to be diverted. The absence of reflected light from the marked boxes trips the G-E photoelectric units and switches boxes to side conveyor. Unmarked boxes continue straight ahead on main conveyor.







DETECTING WEB BREAKS

Problem: Paper mill experienced excess losses caused by web breaks and decided to investigate automatic detection equipment.

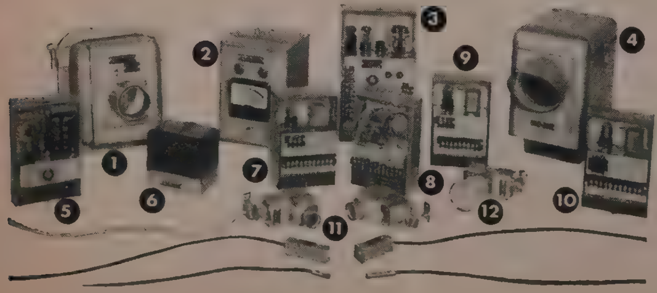
Solution: At G-E Application Engineer's suggestion, plant installed photoelectric web-break detectors. These units detect breaks instantly. Light penetrates through break to scanning photoelectric relay which immediately stops machine.

SENSING LIQUID LEVEL

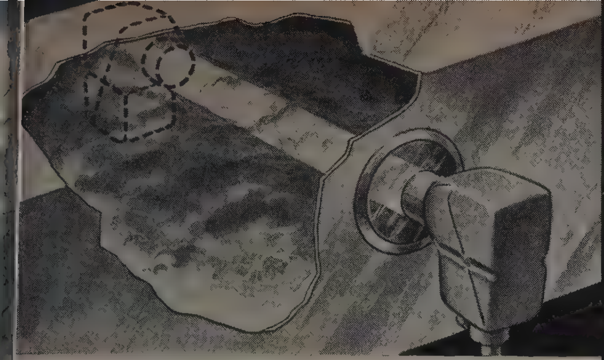
Problem: Brewery planning to add 10 new vats wanted to equip them with most economical liquid level control.

Solution: At the Plant Electrician's suggestion, General Electric resistance-sensitive relays with stainless steel probes were installed on each vat. These standard devices have only one moving part, are easy to install, and require little maintenance.

A complete line of photoelectric and electronic devices for controlling, sorting, limiting,

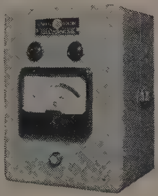


1. **Explosion-proof relay** is high-speed type in special enclosure for use in hazardous locations.
2. **Smoke density indicator** is designed for combustion control or alarm: range is adjustable from 3—100%.
3. **High-speed relay** offers .001-second sensitivity. It also includes time delay and interlock.
4. **Long-distance relay** will operate up to 2500 feet without adverse effects from ambient light.
5. **Voltage-sensitive relay** operates on input signal voltage that ranges above or below pre-selected value.
6. **General-purpose relay** is low-cost, indoor-type photoelectric relay, flexible to operate, easy to adjust.



MEASURING BURNING EFFICIENCY

Problem: To determine that furnace was operating economically, and well within local smoke ordinances.



Solution: Plant Engineer installed G-E electronic smoke density indicator. In addition to performing corrective action, the indicator coupled with a strip chart recorder gives a day-by-day record of burning efficiency. It also satisfies local authorities that smoke is within prescribed limits.

AUTOMATIC CONVEYOR UNLOADING

Problem: Plant wanted to prevent reversing of loaded conveyor upon shut-down of hopper.

Solution: Plant Electrician wired simple electronic timer to hopper switch and to conveyor motor. When hopper closes, timer starts, counts off 45 seconds (long enough for conveyor to dump load completely), then stops conveyor automatically.

counting, and detecting applications

7. **New high-speed relay** is a low-cost unit for use with miniature or micro-miniature source and cell.
8. **Transistorized relay** features high reliability with miniature and micro-miniature source and cell.
9. **Resistance sensitive relay** operates on change in external resistance, ideal for liquid-level control.
10. **Electronic timer** is dial-set for given time; can be energized or de-energized before the timed interval.
11. **Light sources and receivers** are available in standard, miniature, and micro-miniature sizes.
12. **Self-contained relay** is low-cost, compact, tubeless photoelectric relay, ideal for limit-switch-type applications.

CONTROLS
FOR AUTOMATION

6 production problems SOLVED with General Electric electronic devices

These six production problems, and hundreds like them, are today readily solved with versatile General Electric electronic devices.

Applied with ingenuity, these devices now help plants sort, divert, detect, count, and perform other operations efficiently. And new uses turn up every day. For instance, the G-E resistance-sensitive relay is often used to control liquid level, but recently, it proved equally valuable as a thread-break detector!

Cash-in on such new uses of these versatile devices by contacting your authorized G-E Distributor early. He can solve many of your problems with electronic devices from stock. And his experience is invaluable on complex applications.

And for additional information on new ways to apply G-E electronic devices, return the coupon for your free copy of GEA-6822. General Electric Co. *Specialty Control Dept., Waynesboro, Va.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

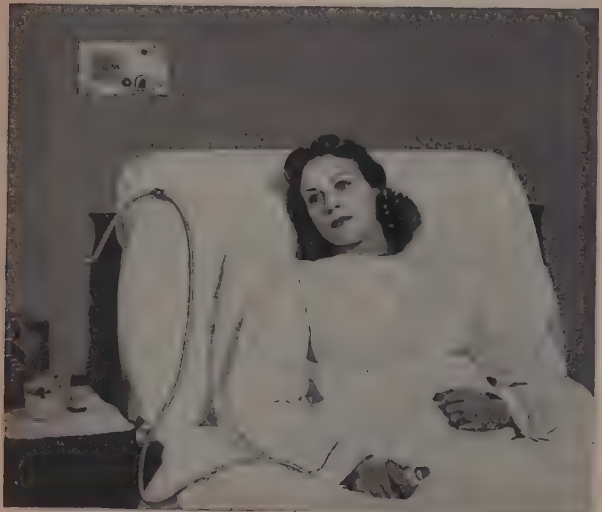
FREE CATALOG

General Electric Co., Section F793-05
Schenectady 5, New York

Please send me a copy of the G-E Electronic Devices catalog, GEA-6822, with description, specifications, and pricing data on the complete line.

Name____
Company______________________________________
Address______________________________________
City______________________State______________

Thousands of Firms Have Profited from
AUTH SIGNALING EQUIPMENT!... Has Yours?



FOR HOSPITALS: *Nurses' Call, Doctors' In-and-Out, and Paging Systems; also, Clock, Fire Alarm Systems, and Ground Detectors.*

FOR SCHOOLS: *Centralized Clock and Program Bell Systems; Fire Alarm Systems; and Products for Vocational Training.*

FOR APARTMENTS: *Apartment House Telephone and Bell Systems: also, U.S. Approved Mail Boxes and Non-Electric Door Chimes.*

FOR INDUSTRY: *Supervisory Annunciators, Audible Signals, and Push Buttons; also, Fire Alarm and Clock Systems.*

The name AUTH on electrical signaling, time, and communication equipment conveys different meanings, all of which can be summed up in one word—profit!

To owners—and their representatives, the architectural and engineering firms—Auth stands for capable assistance in planning requirements, excellent product performance, and minimum upkeep.

To distributors, Auth means easily-consumated orders at the right price—without rejections, delays, or excess paperwork.

To installing contractors, Auth represents well-made, dependable equipment specifically designed to simplify installation. They hook it up and walk away!

Everyone profits when fine equipment—as made by Auth—is specified, purchased, and installed.

If your firm hasn't had experience with Auth signaling equipment, why not start now? An Auth representative will be delighted to be of service. Please call him on your next job. No obligation, of course.

Auth Electric Company, Inc.
LONG ISLAND CITY 1, NEW YORK

SPECIALISTS IN ELECTRICAL SIGNALING AND COMMUNICATION SYSTEMS AND EQUIPMENT

now! save twice on every plug fuse circuit you wire!

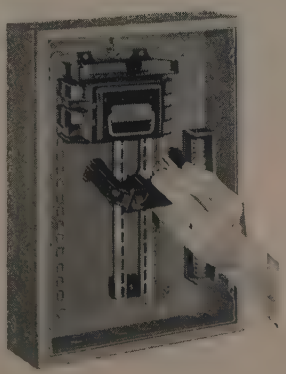
You save twice on every circuit with Federal Pacific's new Type-S stab-in fuse blocks:

First saving: Cost of adapters — none are required!

Second saving: No time lost in handling and installing adapters!

And compliance with N.E.C. requirements for Type-S non-interchangeable plug fuses guarantees inspector's approval.

This newest addition to the famous Federal Pacific SF Fusible system* — available now in 15, 20 and 30-ampere ratings—is another reason why Federal Pacific is first in modular circuit protection!

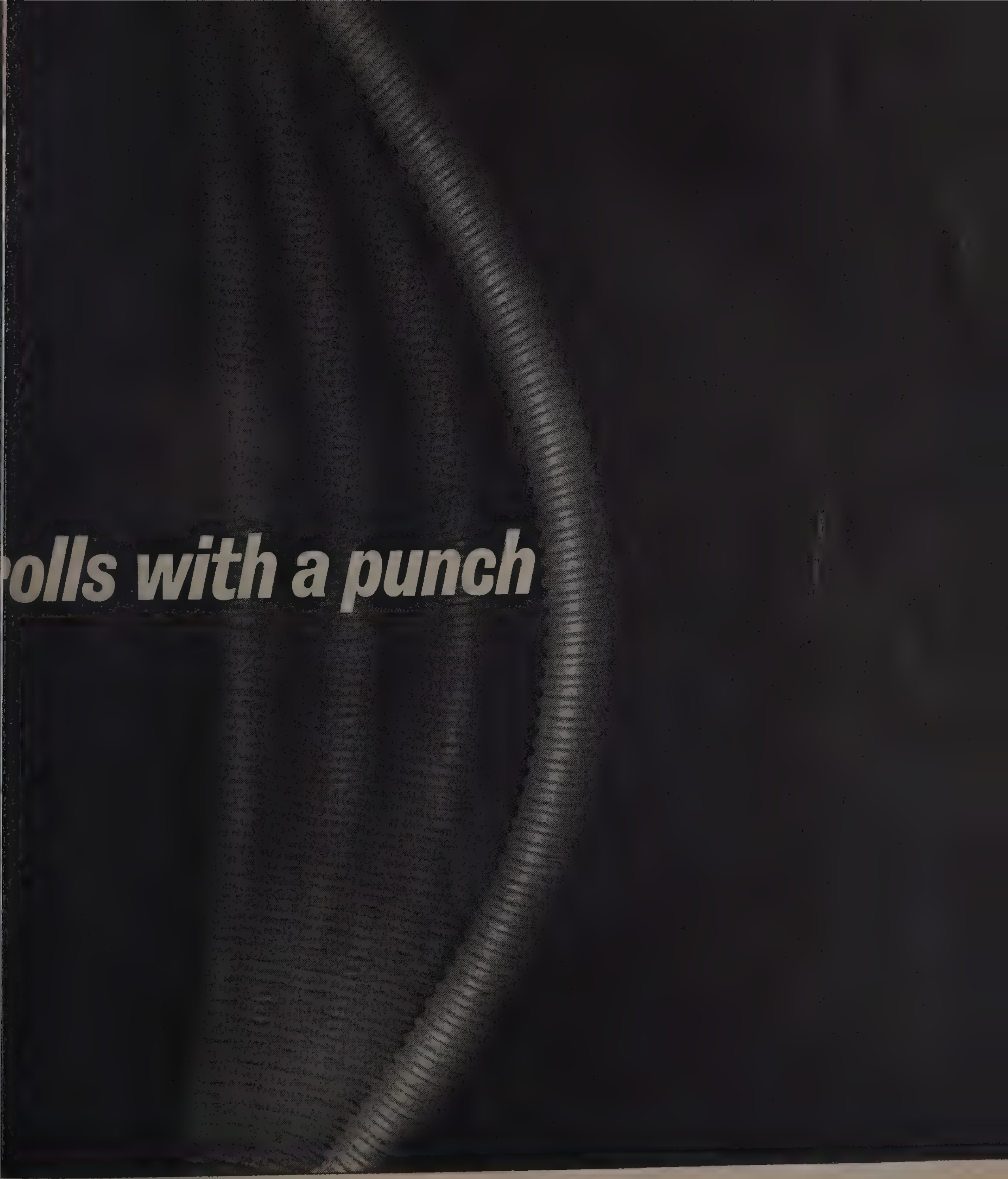


*The SF Fusible System: "Fully empty" enclosures and modular stab-in fusible units. You get flexibility without compromise! / Combination flush-surface enclosures. You get 2 enclosures in 1 . . . in one carton! One item to buy, one item to stock. Use the exclusive picture frame or throw it away . . . at no extra cost! / Hundreds of combinations possible—and those troublesome last-minute changes and additions are easy to make! / Engineered to be trouble-free . . . no profit-killing call-backs!

The Type SF Workbook—Bulletin FB-1-1110—is yours for the asking. Write for your copy today!

FPE FEDERAL PACIFIC ELECTRIC COMPANY
50 PARIS STREET · NEWARK 1, NEW JERSEY

All it takes is one heavy blow to damage suspended rigid conduit but USS Tiger Brand Armorlokt Cable rolls with a punch. Because Armorlokt is flexible, it rolls or gives under pressure without damage. It's not often that you need this built-in "give," but it's there and it can prevent cable failure. Armorlokt protects in other ways, too. Corrosive atmospheres are no problem. You can have the cable armore with galvanized steel, stainless steel, aluminum bronze. Ampyrol (PVC) jackets in color for easy ide tification are also available. And USS Armorlo Cable installs as easily as ordinary cable—in on half the time it takes to install rigid conduit. You ca have the type insulation that best fits your actual jo



quirements—varnished cambric, rubber, or asbes-
in sizes up to four inches in diameter—ratings up
15,000 volts. There's a standard USS Tiger Brand
ble for every special job. Write for the Armorlokt
talog. American Steel and Wire, Dept. 1444,
ckefeller Building, Cleveland 13, Ohio.

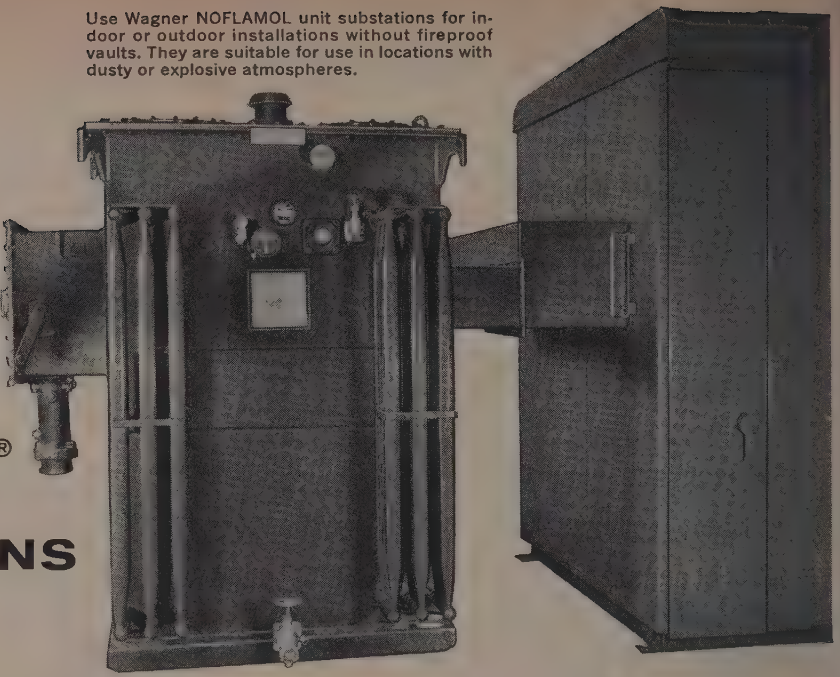
USS, Armorlokt, Tiger Brand and Ampyrol are registered trademarks.

USS

American Steel and Wire
Division of
United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, Distributors Abroad

Use Wagner NOFLAMOL unit substations for indoor or outdoor installations without fireproof vaults. They are suitable for use in locations with dusty or explosive atmospheres.



For better power distribution Use WAGNER® UNIT SUBSTATIONS

They are complete, coordinated load centers that give continuous, dependable power now . . . have plenty of capacity and flexibility for growth

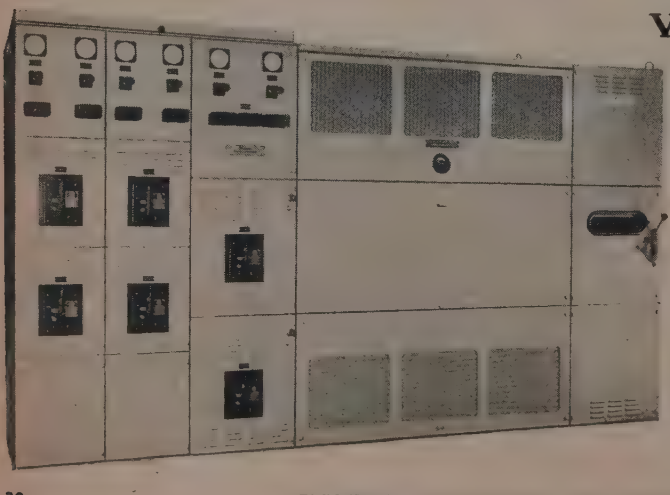
An uninterrupted flow of power . . . that's the important thing in buildings, be they sprawling single-story factories or high-rise offices. And that is what Wagner® unit substations provide.

Designed to improve voltage regulation, and built to be troublefree, they are coordinated load centers that provide the flexibility needed to meet future load requirements. They consist of a proved Wagner transformer, universally acceptable interrupting devices, highly reliable air break switchgear, and metering equipment combined in perfect power packages. To simplify installation, they are factory tested and shipped completely assembled, ready for service. They economically deliver utilization voltage with shorter, less expensive conductor runs . . . lower maintenance costs with modern, protective enclosures . . . safeguard valuable equipment with adequate interrupting capacity. And, substation investment is protected because *one* manufacturer has responsibility for all component parts.

Wagner unit substations are built with transformers rated 112½ through 2000 kva, 3-phase, 60 cycle ratings with high voltages of 2400, 4160, 4800, 6900, 7200, 12000, 13200, or 13800 volts and low voltages of 240, 208Y/120, 480 or 480Y/277 volts.

Four types per NEMA standards are available: sealed dry-type; ventilated dry-type; oil-filled; and Noflamol (non-inflammable liquid-filled).

Wagner Electric Corporation
6413 PLYMOUTH AVENUE, ST. LOUIS 33, MO., U.S.A.



Your Wagner Sales Engineer

will be glad to help you plan any power distribution system. Get complete information on Wagner unit substations from him, or write us for Bulletin TU-152.

Use Wagner VENTILATED DRY-TYPE unit substations indoors. They perform efficiently in any reasonably dry, dust-free, well-ventilated location. Lightweight makes them ideal for use in multi-story buildings.

WT61-8A

Introducing

PLASTI-BOND*

the only complete conduit system permanently protected by fused-on PVC coating

...lowest installed cost for CORROSIVE AREAS

Plasti-Bond is Pittsburgh Standard hot dip galvanized steel conduit, elbows, and couplings, heavily coated with polyvinyl chloride *permanently fused-on at the factory*. Overlapping sleeve design creates tight, pressure sealed joints on couplings and condulets, provides complete protection against corrosive fumes. There is no "corrosion travel", no fume seepage.

Plasti-Bond's unique protection costs less installed than any other effective corrosion-resistant electrical system. *Standard conduit installation methods and tools are used with little or no alteration in technique.*

Complete corrosion-proof conduit systems can be specified in Plasti-Bond, including *Crouse-Hinds* condulets, lighting fixtures, straps, and pull boxes to meet all requirements.

Get the full story on the finest PVC-protected electrical system. Write today.

*Patent Pending

Write for samples and literature.
Pittsburgh Standard Conduit Company,
Verona, Pa.

PLASTI-BOND

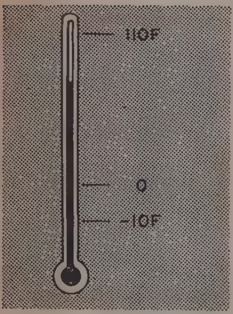
PITTSBURGH STANDARD CONDUIT CO.

GENERAL OFFICE: VERONA, PA.

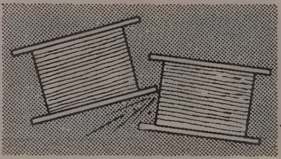
Plants: Verona, Pa. • Morrisville, Pa. • Houston, Tex. • Franklin, Pa. • Gilmer, Tex.

CABLE TALK

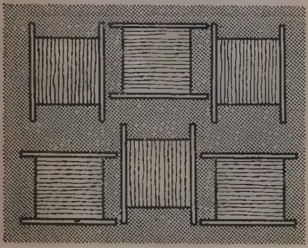
6 tips to help you save money on cable installations

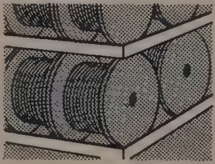


1. Avoid extreme temperatures—below 10F and above 110F (unless cable is specifically designed for this purpose). Low temperatures are seldom harmful to cable, but when they are combined with impact, flexing or other mechanical action, it's possible that the cable may be damaged by cracking, flaking or complete rupture of the coverings. Excessively high temperature, all by itself, can materially shorten the potential service life of stored cable. Thermoplastic components may soften and flow; rubber and many other materials undergo chemical and physical changes at high temperatures. You can avoid this problem by not storing cable near heating units, steam pipes, etc.

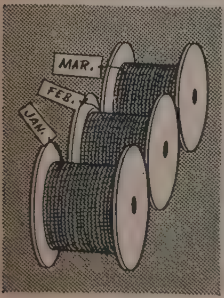


2. Avoid mechanical impact and crushing. Wire on a reel can be rendered useless by allowing the flange of another reel to crash against it. Arranging the stored reels in a crosshatch pattern is the simplest way to avoid this kind of accident. If space is at a premium, the reels may be stored in trays that allow only the flanges of adjacent reels to contact.



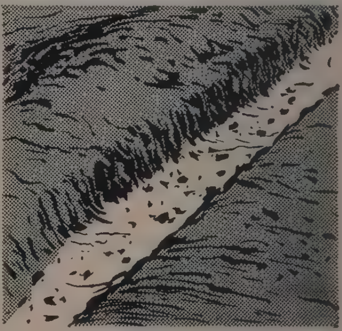


3. Use the oldest stocks first. Very few materials improve with age, so the sooner you use stored cable the longer it will last in service. Also, the less time a cable spends in storage, the less chance there is for damage. Keep rotating stocks so that the newest cable goes to the end of the line.



4. Swab conduit before pulling wire
A remarkable amount of abrasive material—nails, glass and such—can accumulate in conduit, pipe or duct before the wire is pulled through. And pulling a wire or cable through such litter could damage it severely. If you pull a swab through the conduit ahead of the wire to clear the way, you'll eliminate a big source of hidden installation damage.

5. "Direct burial" doesn't mean "on top of anything"
The specification "direct burial" on a cable doesn't mean that you can afford to bury the cable directly on top of whatever you might find in the earth. Trenches should be cleared of rocks and broken glass before the cable is buried. Freezing and thawing can make rocks shift position, and, possibly, exert enough pressure on the cable to cause premature failure. The same danger exists when wires that cross underground rest on each other. Moral: clear trenches before burying cable, bed the cable in sand, and keep crossed cables separated.



6. Pick the strongest component when pulling cable
When wire or cable is being pulled-in, either through conduit or aerially on poles, it's essential to put all the pulling tension on the strongest part of the cable assembly. Ordinary single-conductor material should have pulling tension applied to the bare conductor. Applying tension to the covering materials tends to stretch them, and can lead to breaks in some cases. Always pull preassembled aerial cables by the messenger, not by the insulated conductors. Interlocked-armor cable should never be pulled by the armor, since this may cause severe damage by unlocking the armor.

* * *

This collection of ideas comes from many years of probing into wire and cable problems—and solving them. It's likely that we've come across some problems just like yours, and together we could probably work out a fine solution. So, please give us a call, or write Anaconda Wire and Cable Company, 25 Broadway, New York 4, New York. Department EFL-1-ECM. 61304

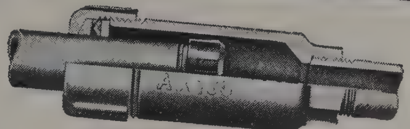
ASK THE MAN FROM

ANACONDA®

FOR TECHNICAL ASSISTANCE ON WIRE AND CABLE PROBLEMS

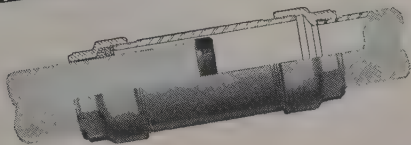
in the long run... it's O.Z.

Type AX



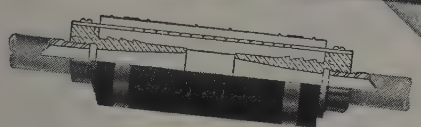
Provides 4" expansion, contraction movement. Malleable iron head, body Hot Dip Galvanized. Weatherproof head sealed by factory-installed high grade graphite packing. Insulating conduit end bushing eliminates cable abrasion. 10 sizes for conduit ½" to 4" diameters.

Type EX



Permits 8" conduit movement. Optional length sleeves, additional cost. Weatherproof head sealed by factory-installed high grade graphite packing. Insulating bushings prevent cable abrasion. Hot Dip Galvanized finish. 12 sizes for ½" to 6" conduit diameters.

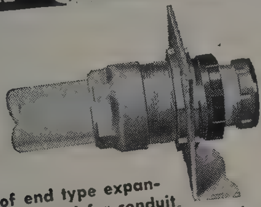
Type DX



Patented

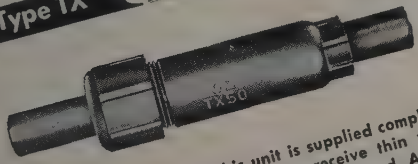
Compensates for deflection, expansion, contraction. ¾" movement all directions from normal; 30° angular movement. Also used as vibration damper between conduit sections. 10 sizes. Watertight (NEMA 4) and submersible under 25 ft. head of water.

Type EXE



Weatherproof end type expansion fitting. Designed for conduit terminating in junction box, where expansion, contraction take place. Supplied complete: locknuts, bushings. Standard finish, Hot Dip Galvanized. 12 sizes.

Type TX



Similar to the Type AX, this unit is supplied complete with extension nipples, ready to receive thin wall couplings. Standard finish is cadmium plated. Available in 6 sizes for conduit ranging from ½" to 2".

for the longer line of EXPANSION FITTINGS

In the long run, no line of conduit is more dependable than its components. When it comes to dependability in expansion fittings, look to O. Z. as the line that measures up! Five basic types provide the dependable answer to your fitting problems in conduit expansion, contraction, and deflection. O. Z. is the dependable line because it's the line with the *right* size, the *right* type, for every requirement! Types AX, DX, EX and EXE available in aluminum at no extra cost.

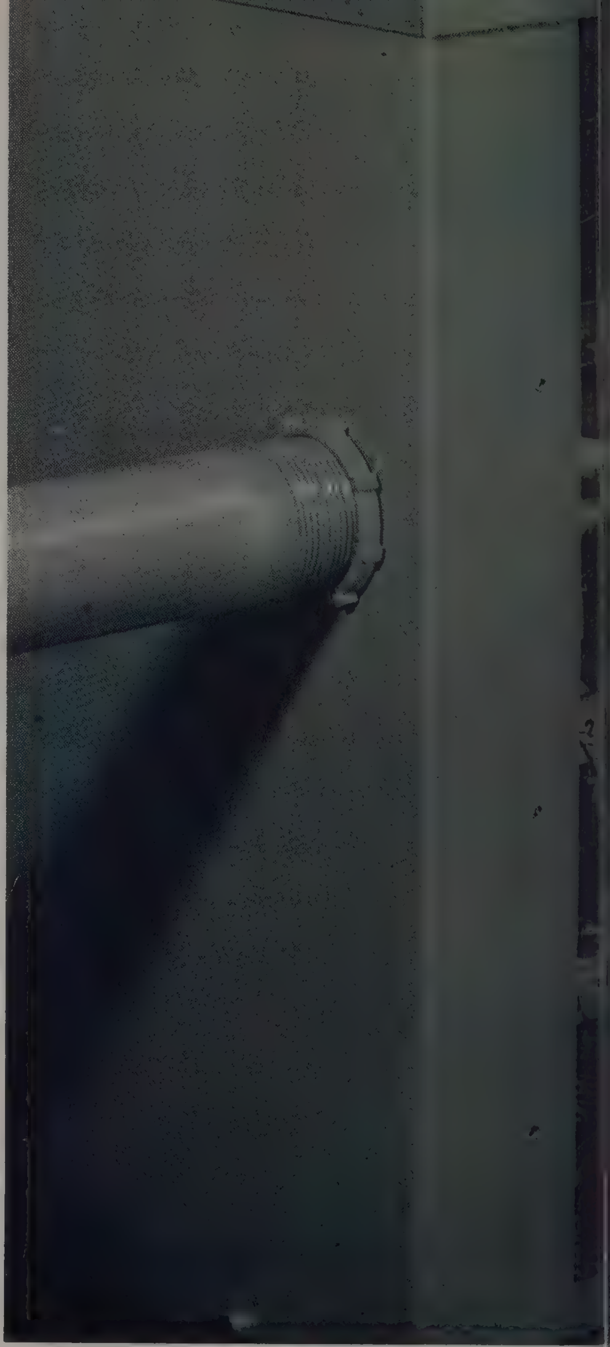
O.Z. ELECTRICAL MANUFACTURING CO., INC.
262 BOND STREET • BROOKLYN 17, N. Y.

- CAST IRON BOXES
- CABLE TERMINATORS
- POWER CONNECTORS
- SOLDERLESS CONNECTORS
- GROUNDING DEVICES
- CONDUIT FITTINGS
- INTERLOCKED ARMOR CABLE FITTINGS

Sales Office and Warehouse: 406 So. Cicero Avenue, Chicago 44, Ill. • ESterbrook 9-0326
Office and Warehouse: 665 So. Van Ness Ave., San Francisco 10, Calif. • GArfield 1-7846

Transformers are shipped on pallets which makes it easy for you to use a fork truck to position General Electric QHT dry-type transformers for mounting.

Keyhole slots hold QHT transformer in place. Built-in mounting provisions eliminate need for wall brackets.



Hook up this General Electric QHT transformer in only 18 minutes

You save time and money every time you install a General Electric QHT dry-type transformer.

First, QHT transformers are easy to handle. They offer savings up to 50 percent in weight and 67 percent in size compared with other dry-types. You can place QHT units near the load and save the cost of long, low-voltage feeders. They don't require vaults, barriers, or ventilating fans.

Entire front panel is removable to expose all terminal and tap connections. All connections are up front.

econd, you wire QHT transformers from the front. There's a complete wiring diagram on the name- late. Dual-sized conduit knockouts are placed so hat you can run cable straight into the connectors. And large, roomy terminal compartments, solder- ess connectors, and numbered terminals help you o complete wiring in 18 minutes.

he new General Electric QHT dry-types are quiet— t least 15 decibels quieter than older designs, making them ideal for schools, hospitals, office buildings, and other places where noise could be a problem. All QHT units have sound ratings equal to or less than NEMA standards. On larger units, welded steel clamps minimize core vibration. The core assembly is mounted on built-in rubber pads to reduce noise transfer through conduits and mounting brackets.

You can get 24 hour delivery on most models from your nearby General Electric distributor. For more information, call him today or write to Section 411-17, General Electric Co., Schenectady 5, N. Y.

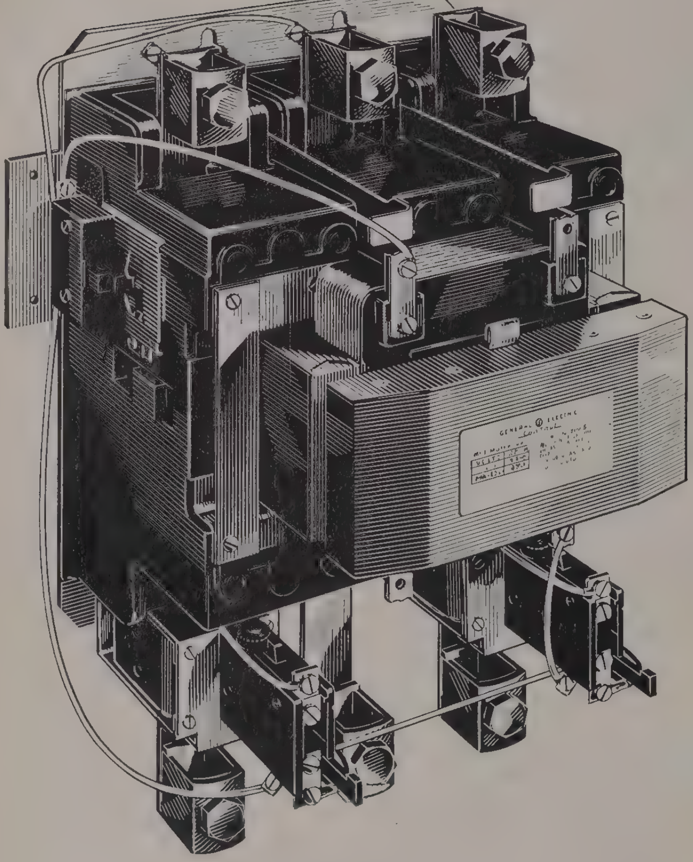
* Registered trademark of General Electric Co. for quiet, high-temperature dry-type transformers.

Progress Is Our Most Important Product

GENERAL ELECTRIC

THE NEWEST STARTER FROM GENERAL ELECTRIC

. . . and what it means to you



NEW NEMA SIZE 5 STARTERS now added to G-E 100-Line feature extremely small size, plus all 100-Line benefits: Height—14¼"; Width—11¾" Area—167.4 sq in.

6 DISTINCT ADVANTAGES YOU CAN'T GET ELSEWHERE

General Electric announces the development of new NEMA Size 5 magnetic starters and contactors—up to 65 percent smaller in open forms than previous designs.

This addition to the G-E 100-Line Starter "family" means you can now get seven sizes that give you six distinct, measurable advantages you cannot get from any other single brand of motor control. They are:

1. **SMALLER SIZE**—particularly in the more popular forms (Sizes 0 and 1). On larger forms, reduced height (as much as 41 percent on Size 5 units alone) saves critical panel space. See dimensions at left below.
2. **EASE OF WIRING**—all terminals are "out front," visible and accessible. Wiring for all sizes is straight through (this can save up to $8 in wire alone for Size 5 installations where line leads come in top and out bottom).
3. **SIMPLIFIED MAINTENANCE AND INSPECTION**—contacts can be inspected or coils changed in less than a minute on all sizes. No tools required on Sizes 00 through 4; only a screwdriver on Size 5.
4. **MORE MODIFICATION KITS**—industry's most complete line lets you modify existing starters on-the-spot in minutes to meet special operating conditions. Result: reduced change-over expense. All starter enclosures have cover knockouts for field-addition of push buttons, selector switches, and indicating lights. Other kits include auxiliary contacts, third overload relay, fuse clips, and coils.
5. **FIELD-*PROVED* DESIGN**—well over 1,000,000 units are operating in the field today. Exhaustive testing in laboratories and on customer applications since the 1957 introduction is your assurance of 100-Line dependability.
6. **"FAMILY" DESIGN BENEFITS**—G.E.'s 100-Line offers all forms and sizes in the same basic design. You benefit from common installation procedures; common maintenance and inspection techniques; reduced inventory; and such operating conveniences as adjustable overload relays for all sizes. Mounting dimensions for Sizes 00, 0, and 1 are identical; so are dimensions for Sizes 3 and 4. Common mounting dimensions and wiring procedures save time and space during panel layout; also when changes occur in horsepower requirements or industry specifications.

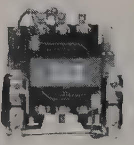
Meet all your control requirements—up through 200 hp—with the uniform, field-proved 100-Line, available in all popular forms: Sizes 00, 0, 1, 2, 3, 4, and 5 contactors and starters; plus combination starters; reversing and two-speed controllers. Contact your G-E sales engineer or distributor, or write Section 811-19, General Electric Company, Schenectady 5, N. Y.

NEMA SIZE 00
H-4 1/2"
W-5 3/32"
A-22.9 sq in.

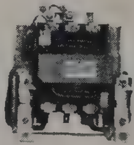
NEMA SIZE 0
H-4 1/2"
W-5 3/32"
A-22.9 sq in.

NEMA SIZE 1
H-4 1/2"
W-5 3/32"
A-22.9 sq in.

NEMA SIZE 2
H-6 5/8"
W-6 1/4"
A-41.6 sq in.



NEMA SIZE 3
H-9 1/2"
W-8 5/8"
A-76.5 sq in.



NEMA SIZE 4
H-10"
W-8 5/8"
A-86.2 sq in.

Progress Is Our Most Important Product

GENERAL ELECTRIC

One of the custom-built Ellis homes at Watch Hills Terrace, Rock Island, Ill. Features include: air conditioning, all-stone double fireplaces, built-in china closets, ornamentation plaster—and telephone planning.

Attractive telephone outlets such as this add to the appearance of the home today, and to the resale value later on.

Your local Bell Telephone Business Office will gladly help you telephone plan your homes. For more information on telephone planning, see Sweet's Light Construction File, 11c/Be. For commercial installations, see Sweet's Architectural File, 34a/Be.

"Our buyers like all the new ideas. That makes telephone planning a must for us"

SAYS MR. T. H. ELLIS, ELLIS COMPANY
ROCK ISLAND, ILL.

"Concealed telephone wiring is a must for the builder of a custom home," says T. H. Ellis, promotion-minded Illinois builder. "Buyers know about it, and they recognize it as a sign of quality in a home. It's one of the newer ideas that we consider essential.

"By planning ahead with both the customer and the Telephone Company's Communications Consultant, we get the most convenient, most practical locations for telephone outlets while the walls are still open."

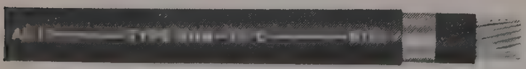
Mr. Ellis has been building homes for twenty years. Since 1957 all of them have been built with concealed telephone wiring. "Now we are also providing for the Bell System's new intercommunications system, Home Interphone."

BELL TELEPHONE SYSTEM

CHANGE NOW TO ALUMINUM AND SAVE THE DIFFERENCE

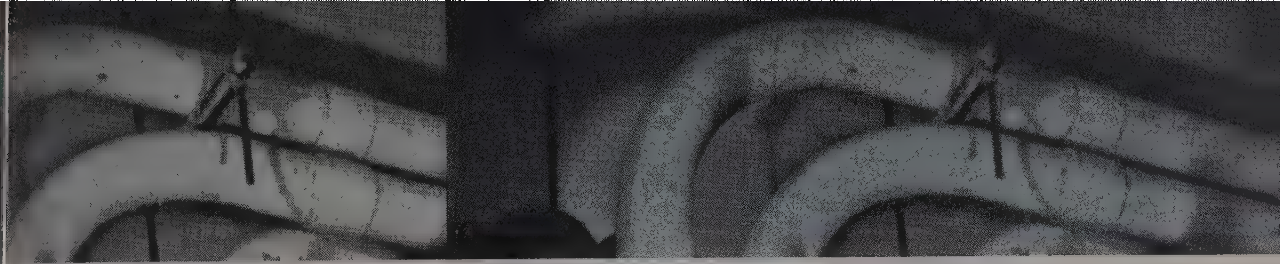
Make the switch from copper to Rome's *aluminum* type RHW building wire and see how you save on every installation

Take a look at the table. It's a convincing story. Installing aluminum wire rather than copper can make a big difference in your profits. Because, for every job, Rome aluminum Type RHW braided building wire costs less than the equivalent in copper. How great the savings on any given installation depends, naturally, on size and amount of wire used. But, as the table shows, there is extra profit for you in every foot of aluminum wire you use. There's another big advantage to aluminum, too. It's lightweight. For example, 1000 feet of 1/0 AWG aluminum Type RHW weighs 147 pounds less than the equivalent in copper. Those are pounds you never have to load, unload, and carry to an installation site. Look at the dollar facts. Look at the ease of handling. Changing to aluminum makes dollars and sense. Get the full story from your nearby Rome distributor. Or write to Rome Cable Division of Alcoa, Dept. 7-111, Rome, New York.



Rome aluminum Type RHW Braided Building Wire is general purpose wiring recommended for lighting and power circuits in residential and commercial construction, and industrial plants where voltage rating does not exceed 600 volts. May be installed in moist locations, in raceway systems, conduit or ducts, or in air. It is approved by Underwriters' Laboratories as Type RHW for operation at 75° C conductor temperature in wet or dry locations.

ALCOA
ROME CABLE
DIVISION



ROME TYPE RHW BRAIDED BUILDING WIRE

U/L Listed for 75° C wet or dry—600 volts

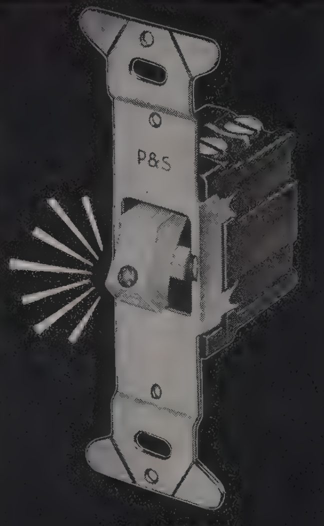
COPPER			ALUMINUM			SAVINGS	
SIZE	STRANDS	LIST PRICE	SIZE	STRANDS	LIST PRICE	DOLLARS	PERCENTAGE (Approx.)
6	7	$77.60	4	7	$63.40	$14.20	18%
2	7	155.40	1/0	19	117.00	38.40	24%
4/0	19	477.80	300 MCM	19	350.00	127.80	26%
00 MCM	37	1098.30	750 MCM	61	814.00	284.30	25%

NOW!

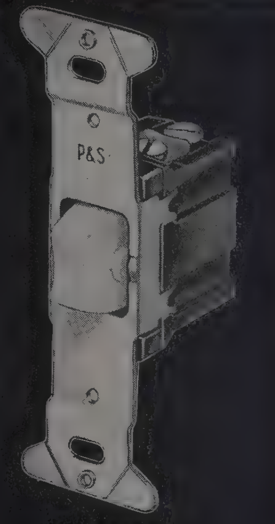
3 NEW *P&S ROCKER-GLO SWITCHES!*

No. 2211-SL

No. 2211-SL also available in strap type No. 2221-SL


No. 2221-SP

No. 2221-SP also available in Despard (interchangeable) type No. 2211-SP


No. 2225-S

No. 2225-S also available in Despard (interchangeable) type No. 2215-S

1

LIGHTED HANDLE ROCKER-GLO

Pinpoints switch location in darkened rooms or hallways. Tiny, long-life neon lamp softly glows in OFF position only. Single pole or three-way. Rating: 15 Amperes, 120 Volts, A.C.

2

Pilot Light HANDLE ROCKER-GLO

Instantly shows when appliances or lights are on. Tiny red plastic jewel in rocker button lights in ON position only. Single pole only. Rating: 15 Amperes, 120 Volts, A.C.

3

REMOTE CONTROL ROCKER-GLO

Momentary contact, center "off" switch. Designed especially for low voltage remote control applications—controlling large banks of lighting, operating stage curtains, etc. Single pole, double throw. Rating: 10 Amperes, 48 Volts, A.C.

For more information write Dept. ECM1161

P&S

PASS & SEYMOUR, INC.
SYRACUSE 9, NEW YORK

60 E. 42nd St., New York 17, N.Y. 1440 N. Pulaski Rd., Chicago 51, Ill. In Canada: Renfrew Electric Co., Ltd., Toronto, Ontario

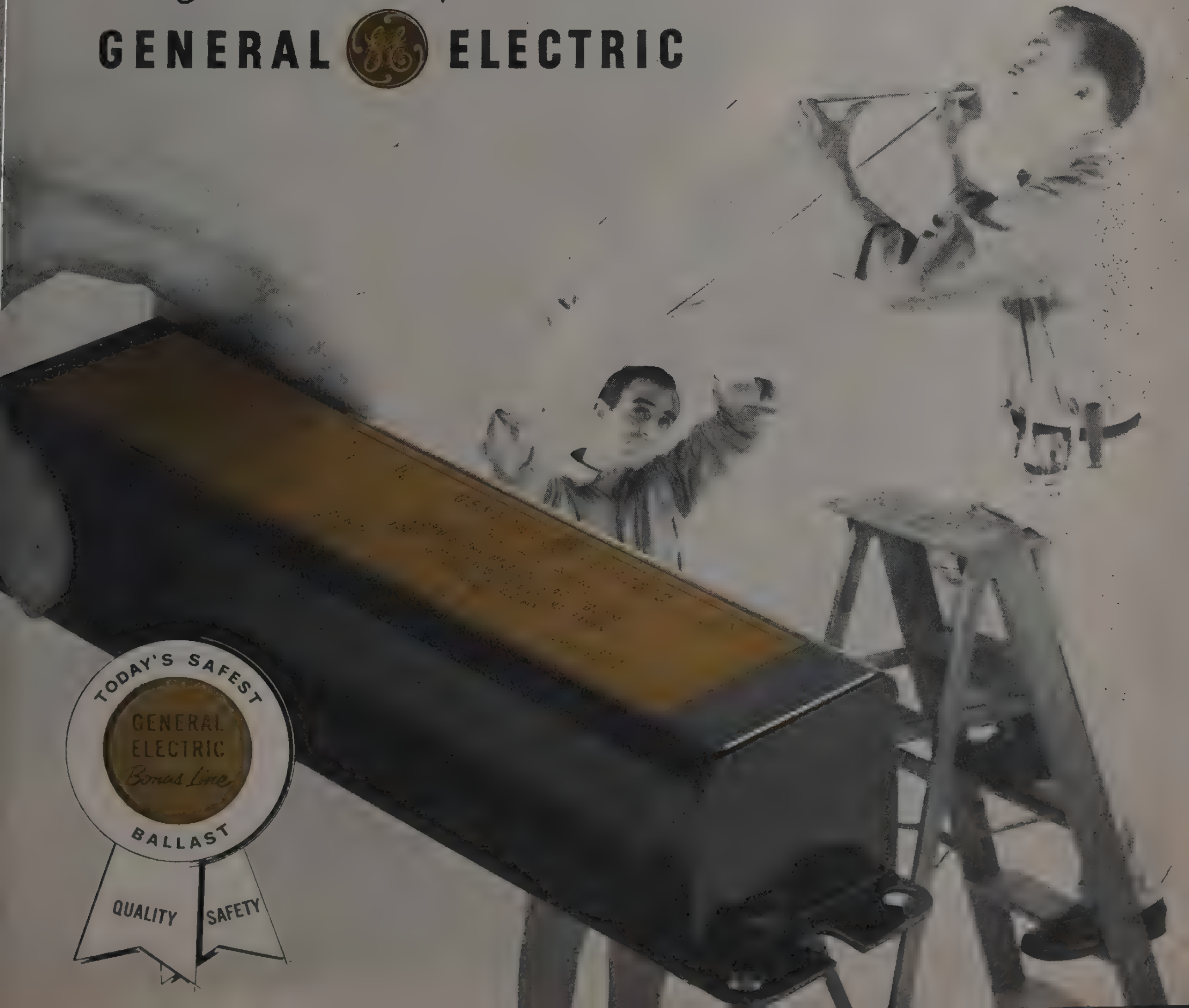
Your lighting projects require the *safest* fluorescent ballasts you can specify . . . General Electric Bonus Line*. These ballasts are designed to protect against leaking, smoking, burning—*all* potential hazards or annoyances at end of life. They feature a unique, non-resetting thermal protection system—better than the best fusing—for unmatched, incident-free operation throughout their full, useful life. Put the fullest measure of lighting protection into your buildings. Write premium-quality General Electric Bonus Line ballasts into your lighting specifications.

*Trade-mark of General Electric Company

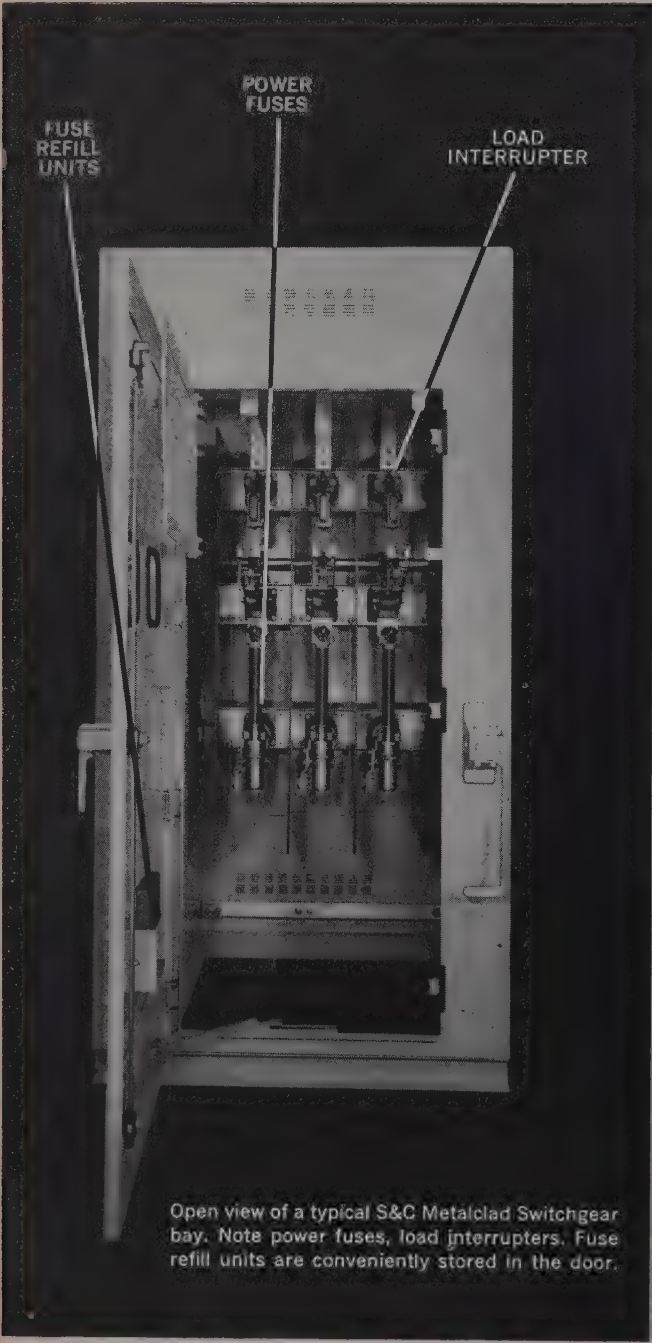
For a detailed engineering report on Bonus Line ballasts, contact your G-E Sales Engineer or write Section 403-03, General Electric Company, Danville, Illinois.

Progress Is Our Most Important Product

GENERAL ELECTRIC



Leave it to the girls



Open view of a typical S&C Metalclad Switchgear bay. Note power fuses, load interrupters. Fuse refill units are conveniently stored in the door.

They can handle all the maintenance your 2.4 thru 14.4-kv switchgear ever needs . . .

. . . if it's S&C Metalclad Switchgear, that is. For S&C Metalclad Switchgear contains maintenance-free fused load interrupters. (Load interrupters handle all load switching; power fuses handle fault protection.) Fused load interrupters will always work—never need adjusting, setting, inspection, dielectric testing, or periodic exercising and lubrication. Compared to the suggested maintenance schedules for circuit breaker type switchgear, there's virtually no maintenance required.

Equally important, unqualified maintenance personnel can't tamper with planned fault protection—since power fuses employ no relays. What's more, the operating characteristics of S&C power fuses do not change with age or current surges. Current-carrying ability and time-current characteristics of these fuses are permanent.

Remember, too, that this switchgear will cost about half as much as the circuit breakers you might be used to. And it offers full-load switching up to 1200 amperes plus fault interrupting up to 500,000 kva in voltages from 2.4 thru 14.4 kv. It meets all NEC requirements for fault-closing and short-circuit interruption . . . and its performance is proved by high-power tests at KEMA laboratories.

Next time you are thinking about high-voltage switchgear for service entrances, switching centers, substation primaries or substation secondaries . . . leave it to the girls as far as maintenance is concerned. As far as application help is concerned, leave it to your S&C sales engineer. Look for him in the Yellow Pages (Electrical Equipment) in all principal cities. Or write to:

S&C

S&C ELECTRIC COMPANY
4433 Ravenswood Avenue • Chicago 40, Illinois
Specialists in High Voltage Circuit Interruption since 1911

Equipment shown is an S&C Metalclad Switchgear Assembly (13.8 kv) used as a switching center. (Dusting is optional!)

Not long ago a new type of fixture was born... Corona, the first fluorescent fixture to be designed as a decorative element. Framed in polished walnut, it's manufactured with all the care that goes into making a fine piece of furniture. Understandably, it's expensive... with a much better than average profit for the electrical contractor. But cost didn't keep it from being one of the best sellers introduced last year... by anyone. On

THESE TWO PROVE THERE

LIGHT

Jersey City 5, New Jersey / Showrooms: New York, Chicago, Dallas, Los Angeles

LIGHTOLIER fixtures are stocked by these Authorized Distributors:

ALABAMA
Birmingham
Mayer Elec. Sup. Co.
Mobile:
F. E. Smith Elec. Co.

ARIZONA
Phoenix
Brown Wholesale Elec.
Tucson
Beacon Ltg. Fix. Co.

ARKANSAS
Little Rock
Adcock Ltg. & Sup.

CALIFORNIA
Bakersfield
San Joaquin Whlse. Elec. Co.
Fresno
Electrical Suppliers, Inc.
Los Angeles
[illegible]
[illegible]
[illegible] Whlsrs.
[illegible]
[illegible]
Sacramento.
Capital Whlse. Elec. Co.
San Bernardino:
Tri-County Elec. Whlsrs.
San Diego:
Sunlight Elec. Sup. Co.
San Francisco:
California Elec. Sup. Co.

COLORADO
Denver
Central Elec. Sup. Co.

CONNECTICUT
Bridgeport:
B. M. Tower Co., Inc.
Hartford
Beacon Light & Sup. Co.
New Haven
Grand Light & Sup. Co.
New London
United Elec. Sup. Co.
South Norwalk:
Klaff's Inc
Stamford
Marle Co
Waterbury
Starbuck Sprague Co.
Suburban Supply Co

DISTRICT OF COLUMBIA
Washington:
Maurice Elec. Sup. Co.
National Elec. Wholesalers

FLORIDA
Miami
Farrey's Whlse. Hdwe. Co.

GEORGIA
Atlanta
Atlanta Ltg. Fix. Co.
Electrical Wholesalers
Noland Co.
Augusta.
Hart Elec. Sup. Co.
Columbus
P. & W. Elec. Sup. Co.
Macon
Noland Co

HAWAII
Honolulu
Hawaiian Light & Sup. Co.

ILLINOIS
[illegible]
[illegible] Sup. Co
[illegible]
[illegible] Sup. Co
Englewood Elec. Sup. Co.
Harlo Elec. Sup. Co.
Hyland Elec. Sup. Co
Metropolitan Elec. Sup.
Steiner Elec. Co
Wholesale Elec. Sup. Co.
Elgin
Fox Elec. Sup. Co
Joliet.
Joliet Elec. Sup
Rockford.
Englewood Elec. Sup. Co.
Springfield:
Springfield Elec. Sup. Co.

INDIANA
Ft. Wayne
Mossman-Yarnelle Co.
Gary
Englewood Elec. Sup. Co.
Indianapolis
Farrell-Argast Elec. Co.
South Bend
Englewood Elec. Sup. Co.

IOWA
Des Moines
Weston Lighting, Inc.

KANSAS
Kansas City:
W. T. Foley Elec. Co.
Wichita
Architectural Lighting, Inc.

KENTUCKY
Louisville:
Henry J. Rueff Co.

LOUISIANA
Baton Rouge:
Electrical Wholesalers, Inc.
New Orleans:
Interstate Elec. Co.

MAINE
Bangor
Standard Elec. Co
Portland
Holmes Elec. Supply Co.

MARYLAND
Baltimore
Baltimore Gas Light Co
Dominion Elec. Sup. Co
Hagerstown:
Noland Co
Tristate Elec. Sup. Co.
Salisbury:
Artcraft Elec. Sup. Co.

MASSACHUSETTS
Boston:
Boston Lamp Co.
Mass. Gas & Elec. Light Co
Henry L. Wolfers, Inc.
Pittsfield:
Carr Supply Co
Springfield:
M. W. Zimmerman Inc
Worcester
Benjamin Elec. Sup. Co

MICHIGAN
Detroit
[illegible]
[illegible] Co
[illegible]
[illegible]
Grand Rapids
[illegible] Sup. Co
[illegible]
[illegible] Wholesale Sup. Co
Lansing.
Michigan Elec. Sup. Co.
Muskegon:
Fitzpatrick Elec. Sup. Co.
Saginaw:
Schmerheim Elec. Co.
Standard Elec. Sup. Co.

MINNESOTA
Duluth:
Northern Elec. Sup. Co.
Minneapolis.
North Central Elec. Distr. Co.
Northland Elec. Sup. Co.
St. Paul.
Lax Elec. Co.

MISSISSIPPI
Jackson
Stuart C. Irby Co.

MISSOURI
Kansas City
Glasco Elec. Co
Rossner Elec. Sup. Co.
St. Louis
M. K. Clark
Springfield
Southern Materials Co.

MONTANA
Great Falls:
Glacier State Elec.

NEBRASKA
Lincoln:
White Electric Supply Co.
Omaha:
Electric Fix. & Sup. Co.

NEVADA
Reno:
Western Elec. Dists. Co.

NEW HAMPSHIRE
Portsmouth:
Mass. Gas & Elec. Light Co.

NEW JERSEY
Atlantic City:
Franklin Elec. Sup. Co
Camden
National Elec. Sup. Co

NEW MEXICO
Albuquerque.
The Lighting and Main Co

e heels of this success came Coronet, cut to the same pattern of profit and craftsmanip, but designed to create a more formal effect. It's made of steel...finished in amel...shaped to present a finely sculptured appearance. Golden anozed aluminum louvers add a subtle luster. Both fixtures are available either stem surface mounted in five sizes: 54" x 54", 42" x 42", 30" x 30", 32" x 54", 16" x 54".

IS PROFIT IN GOOD DESIGN

New 96 page catalogue shows over 1000 lighting devices. For your copy, write Dept. EC11.

OLIER®

...for a better way of Light

EW YORK
nghamton:
[illegible] Sup. Co.
ffalo
ffalo Incand. Light Co. Inc.
nauet (Rockland Co.):
ockland Lighting
iagara Falls:
[illegible] Supplies Inc.
[illegible]
[illegible] Sup. Co.
[illegible]
[illegible] Electric Sup. Co.
henectady
[illegible] Elec. Sup. Co.
yracuse:
uperior Elec. Corp.
hite Plains
olar Lighting Corp.
ORTH CAROLINA
Asheville
lectric Sup. Co.
Charlotte:
Indepedent Elec Sup. Co.
Durham:
oland Co
Greensboro:
Elec. Sup. & Equip. Co.
High Point:
Electric Sup. Inc.
Kinston:
Kinston Elec.
Raleigh:
Electrical Equipment Co.
Winston-Salem:
Noland Co.

NORTH DAKOTA
Fargo:
Border States Elec. Sup. Co.
Northwest Elec. Sup. Inc.

OHIO
Akron:
The Sacks Elec. Sup. Co.
Canton:
Electric Sales Co.
Cincinnati:
B & B. Elec. Co.
F. D. Lawrence Electric Co.
Richards Elec. Sup. Co.
Cleveland:
The H Leff Electric Co.
Midland Elec Co.
Columbus:
Elgee Elec. Co.
The Loeb Elec. Co.
Dayton:
Duellman Elec. Co.
Springfield:
The W. W. Elec. Co.
Toledo:
Gross Elec. Fix. Co.
Youngstown:
The Braff Ltg. Fix. Co.

OKLAHOMA
Oklahoma City:
Elec. Sup. of Oklahoma
Hunzicker Bros.

OREGON
Portland.
Baker Barkon Co.
Malloy Robinson Co.

PENNSYLVANIA
Allentown:
Coleman Elec. Co.
Erie:
Kraus Elec. Co.
Harrisburg:
Fluorescent Sup. Co.
Schaedler Bros.
Hazleton:
Power Elec. Co. Inc.
Lancaster:
Jno. E. Graybill & Co.
New Castle:
Midwestern Elec. Co.
Norristown:
Norristown Elec. Sup. Co.
Philadelphia:
Gold Seal Elec. Sup. Co.
Logan Elec. Sup. Co., Inc.
Pyramid Elec. Sup. Co., Inc.
Silver's Elec Sup. Co.
Sylvan Elec. Fix. Co.
West Phila. Elec. Sup. Co.
Pittsburgh:
Allied Elec Sup. Co.
Argo Lite Studios
Brown & Green
Wally Elec. Sup. Co.
Reading:
Coleman Elec. Co.
Scranton:
Lewis & Reif, Inc.
Uniontown:
Pioneer Electric Dist.
West Chester:
West Chester Elec. Sup. Co.
Wilkes-Barre:
Anthracite Elec.
Williamsport
Lowry Electric Co.
York:
Jno. E. Graybill & Co.

RHODE ISLAND
Pawtucket
Major Elec. Sup. Co.
Providence:
Leavitt Colson Co.
Tops Elec. Sup. Co.

SOUTH CAROLINA
Columbia:
Capital Elec. Sup.
Noland Co.
Greenville:
Sullivan Hdwe. Co

SOUTH DAKOTA
Watertown:
J. H. Larson Elec. Co.

TENNESSEE
Chattanooga:
Mills & Lupton Sup. Co.
Noland Co.
Knoxville:
The Keener Co.
Memphis:
Belvedere Lighting Co.
Nashville:
Nashville Elec. Sup. Co.

TEXAS
Brownsville:
Electric Fix. Sup. Co.
Dallas:
Rogers Elec. Sup. Co.
Ft. Worth:
Anderson Fixture Co.
Cummins Supply Co
General Industrial Sup. Corp
Houston:
Anderson Lighting Co
Gulf Coast Elec. Sup. Co. Inc
Marlin Associates
Worth Elec. Sup. Co
San Antonio
Electrical Distrib. Co.
Southern Equip. Co
Strauss-Frank Co.
Worth Elec. Sup. Co.
Waco:
Dealers Elec. Sup. Co.

UTAH
Salt Lake City:
Artistic Lighting

VIRGINIA
Arlington:
Dominion Elec. Sup. Co. Inc.
Noland Co
Lynchburg:
Mid-State Elec. Sup. Co. Inc.
Roanoke
Noland Co

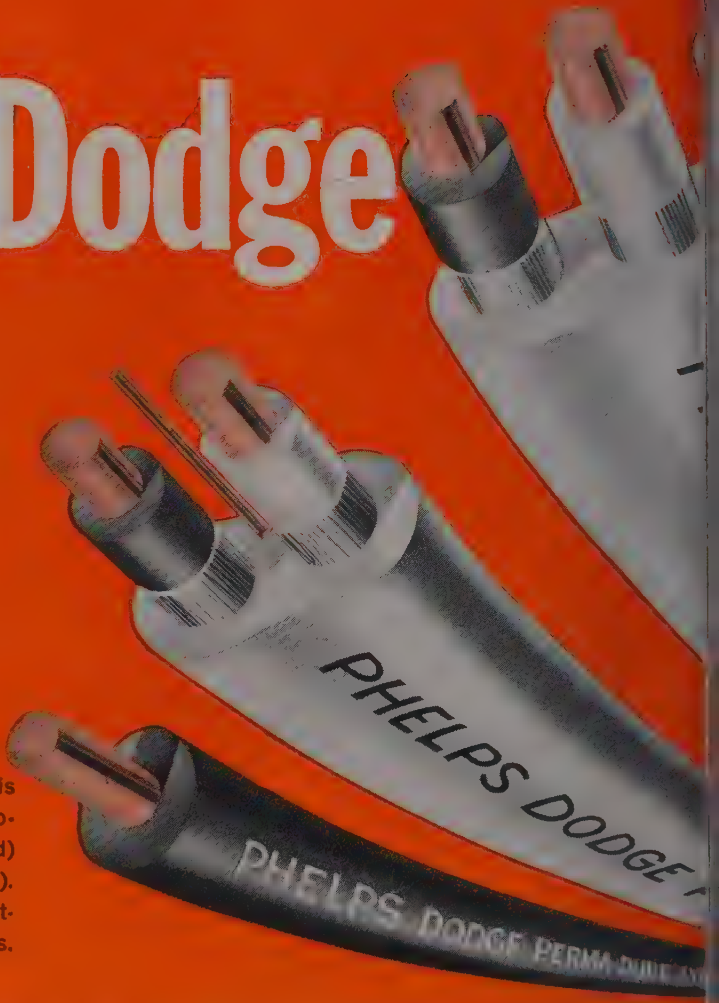
WEST VIRGINIA
Charleston
Capitol Light Co.
Goldfarb Elec. Sup. Co.

WISCONSIN
Appleton
Moe Northern Co.
Eau Claire:
W. H. Hobbs Supply Co.
La Crosse:
W. A. Roosevelt Co.
Milwaukee:
Electri-Craft Lighting
Lappin Electric Co.
Standard Elec. Sup. Co.
Racine.
Milch Elec. Sup. Co.

WASHINGTON
Seattle:
Seattle Lighting Fix. Co.

CANADA
Edmonton:
Alberta Elec. Sup. Ltd.
Montreal:
L. D. G. Products, Inc
Gray Elec. Co
Union Elec. Sup. Co. Ltd.
Toronto:
Revere Elec. Dist
Toronto Ltg Studios
Union Elec Sup

Phelps Dodge



Perma-Dure single conductor cable is insulated with Habirdure (thermoplastic). Sizes 14 through 8 AWG (solid) and 6 through 4 AWG (seven strand). Standard color is black. Underwriters approved as Type UF-600 volts.

An Economical, Dependable Cable for • Underground

Perma-Dure, a Phelps Dodge product, provides electrical contractors with a durable, versatile type of flame-resistant cable for industrial and commercial use.

Perma-Dure handles easily, strips readily and helps cut installation time and costs. It is supplied in single, two and three conductors for feeder or branch circuits. Under the 1959 National Electrical Code, *Perma-Dure* is recognized as suitable for:

Type UF, single and multiple conductor, as feeder or branch circuit cable, for direct burial in the earth when provided with over-current protection.

Multipurpose

Perma-Dure!

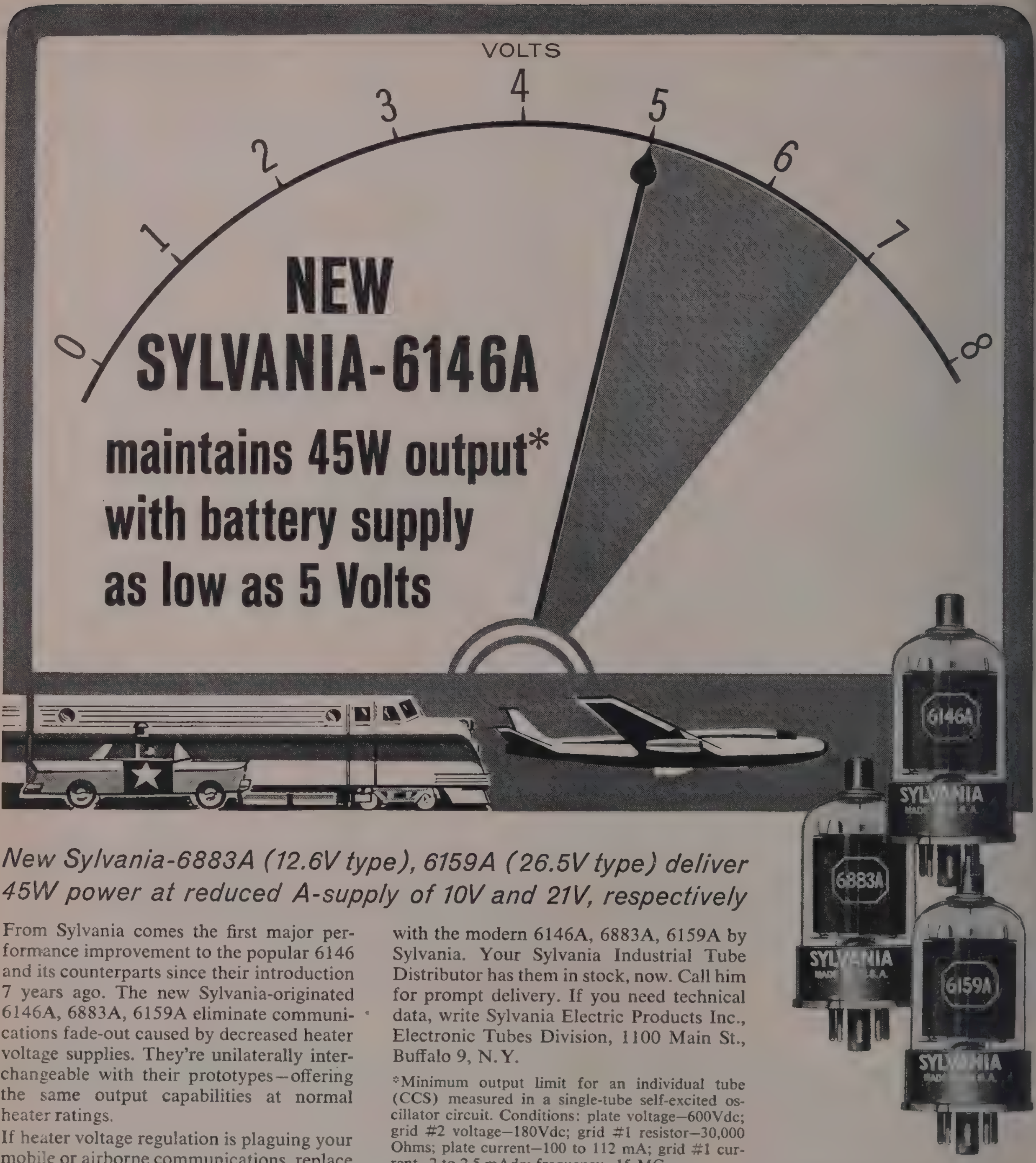
Perma-Dure two and three conductor cable is insulated with Habirdure, glass-wrapped. Conductors laid parallel under a Habirdure sheath. Sizes 14 through 10 AWG. Standard color is white. Underwriters approved as Type UF and Type NMC-600 volts. Available with and without ground wire.

Wiring Including Direct Burial • Interior Wiring

Type NMC, multiple conductor (moisture and corrosion resistant non-metallic sheathed cable) for installation in exposed or concealed locations, in dry, damp or corrosive conditions; inside masonry or tile walls; or embedded, when suitably protected, in plaster or shallow chase in masonry.

See Your Phelps Dodge Distributor!

PHELPS DODGE COPPER PRODUCTS
CORPORATION
300 Park Avenue, New York 22, N. Y.



NEW SYLVANIA-6146A

maintains 45W output* with battery supply as low as 5 Volts

New Sylvania-6883A (12.6V type), 6159A (26.5V type) deliver 45W power at reduced A-supply of 10V and 21V, respectively

From Sylvania comes the first major performance improvement to the popular 6146 and its counterparts since their introduction 7 years ago. The new Sylvania-originated 6146A, 6883A, 6159A eliminate communications fade-out caused by decreased heater voltage supplies. They're unilaterally interchangeable with their prototypes—offering the same output capabilities at normal heater ratings.

If heater voltage regulation is plaguing your mobile or airborne communications, replace with the modern 6146A, 6883A, 6159A by Sylvania. Your Sylvania Industrial Tube Distributor has them in stock, now. Call him for prompt delivery. If you need technical data, write Sylvania Electric Products Inc., Electronic Tubes Division, 1100 Main St., Buffalo 9, N.Y.

*Minimum output limit for an individual tube (CCS) measured in a single-tube self-excited oscillator circuit. Conditions: plate voltage—600Vdc; grid #2 voltage—180Vdc; grid #1 resistor—30,000 Ohms; plate current—100 to 112 mA; grid #1 current—2 to 2.5 mAdc; frequency—15 MC.

RF amplifier output, Class C service—70W (ICAS) up to 60 MC, 35W (ICAS) up to 175 MC.

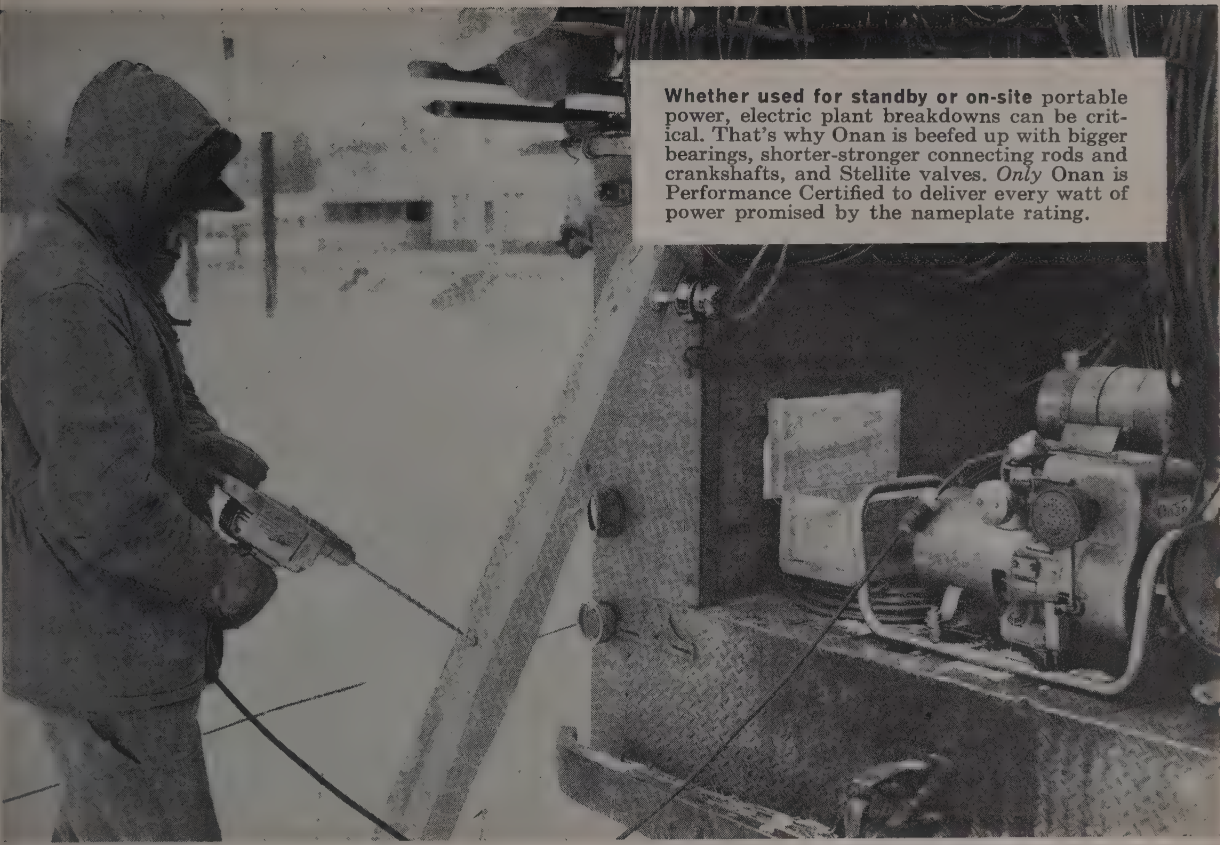
Available from your Sylvania Industrial Tube Distributor

SYLVANIA

SUBSIDIARY OF

GENERAL TELEPHONE & ELECTRONICS

GENERAL SYSTEM



Whether used for standby or on-site portable power, electric plant breakdowns can be critical. That's why Onan is beefed up with bigger bearings, shorter-stronger connecting rods and crankshafts, and Stellite valves. *Only* Onan is Performance Certified to deliver every watt of power promised by the nameplate rating.

Only Onan is certified to give you all the power promised by its nameplate

It's a fact that many electric plants on the market today do not deliver the output promised by their nameplate rating.

Every Onan plant is given a rugged workout *under full load* before it is shipped—*your assurance* that the Onan you buy is ready for hard work the day you get it.

But this isn't enough. Independent laboratory inspectors pull surprise inspections to double-check our tests and testing methods. They pull a plant off the line, run it, stop it, load it, overload it, check and recheck. Their torture test gives positive proof of Onan's quality. End result: *Onan's exclusive Performance Certification* . . . your assurance of getting every watt of power you pay for.

So when you're tempted by an electric plant "bargain," make sure its nameplate rating is not "inflated." Be sure you're getting full measure for your money. Remember, *the electric plant that short-changes you in power output is no bargain at any price!* Only Onan is Performance Certified to deliver everything the nameplate promises.

See Onan electric plants soon. Compare before you buy. You'll find your Onan distributor listed in the Yellow Pages. Call him or write direct.

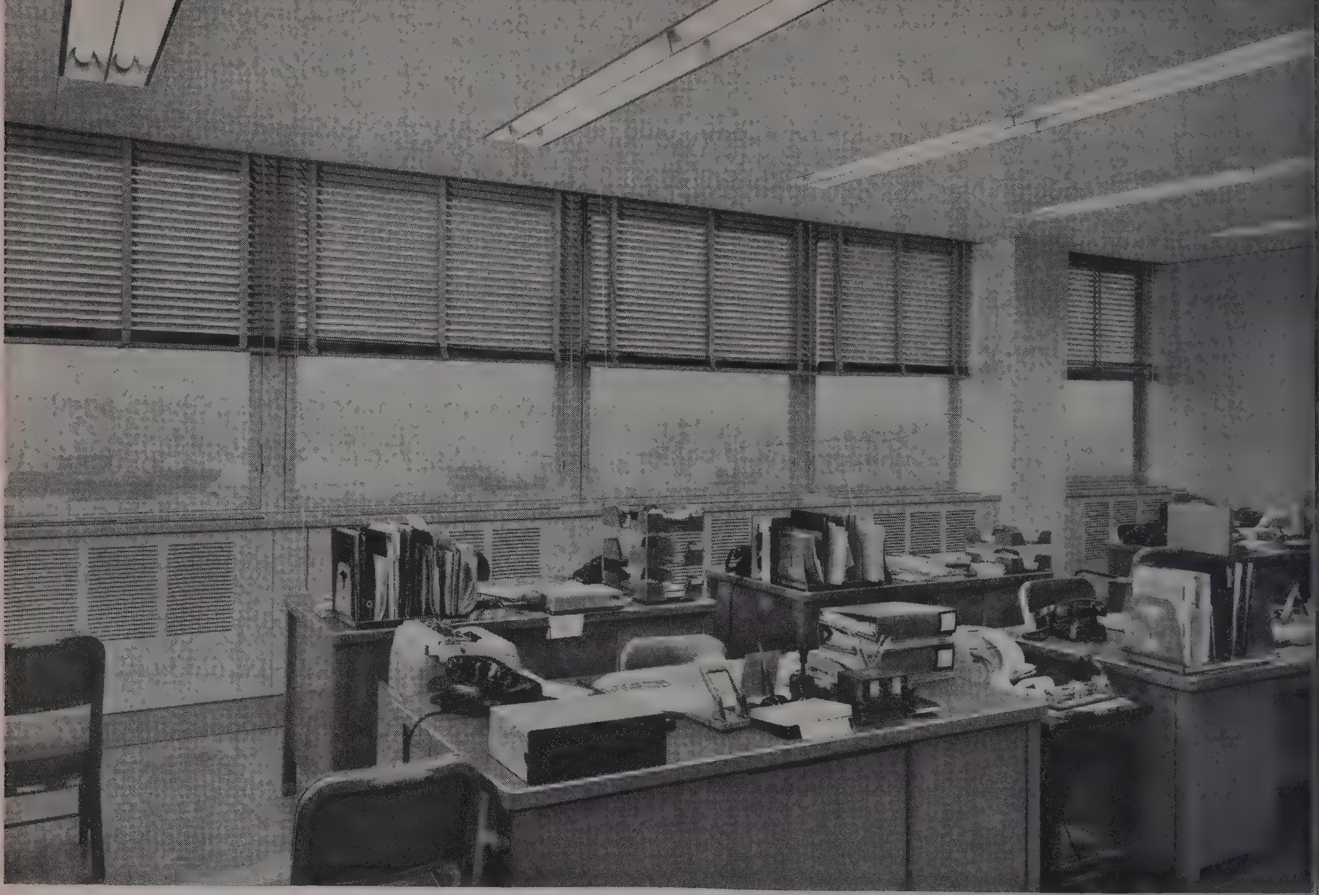
PERFORMANCE CERTIFIED

We certify that when properly installed and operated this Onan electric plant will deliver the full power and the voltage and frequency regulation promised by its nameplate and published specifications. This plant has undergone several hours of running-in and testing under realistic load conditions, in accordance with procedures certified by an independent testing laboratory.

World's Leading Builder of Electric Power Plants

Onan

ONAN Division, Studebaker-Packard Corporation, 2583 University Ave. S. E., Minneapolis 14, Minn.



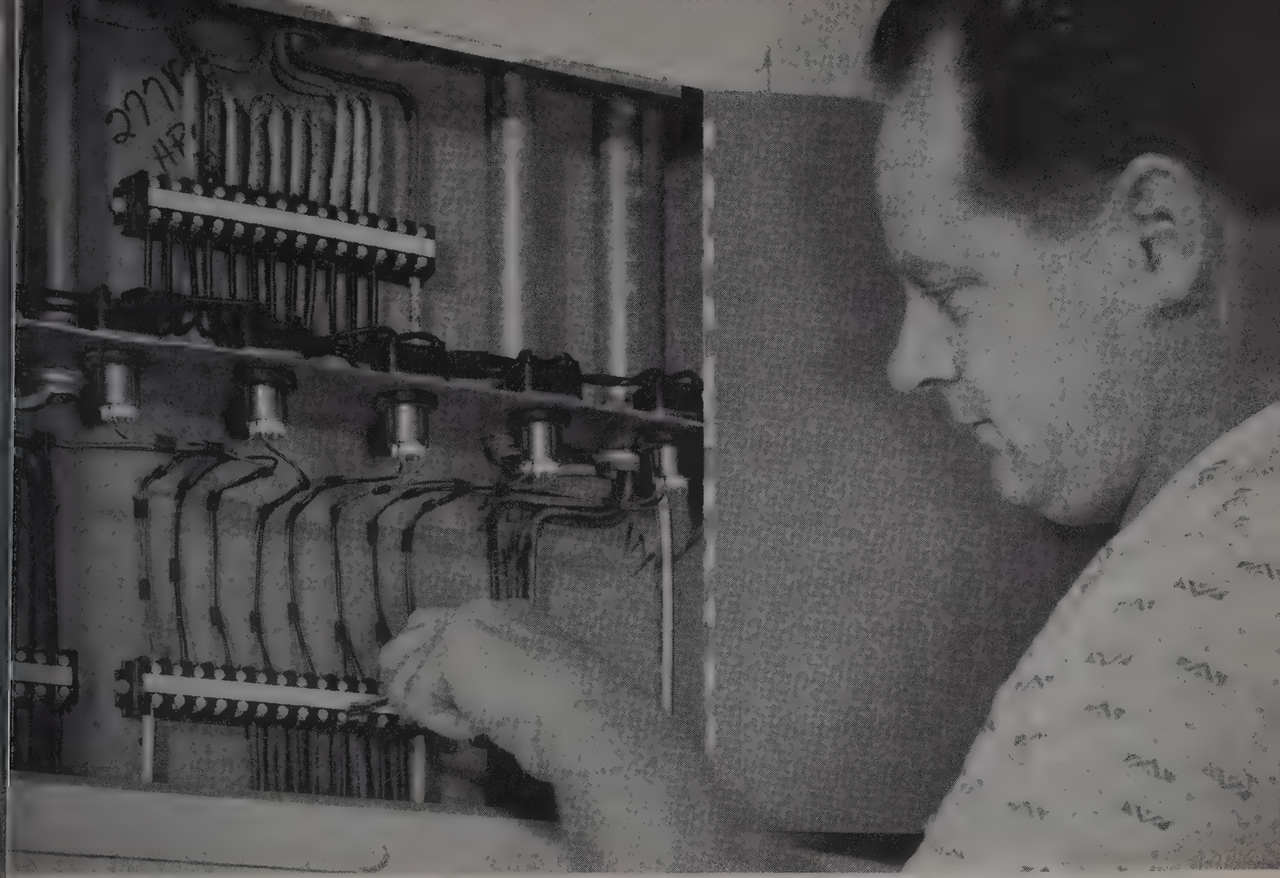
Space is divided in multiples of "one window" modules, each with its own row of lighting. Switching must change with partitioning, to give employees convenient control of lights in new rooms.

G-E Remote-Control switches locate
manently inside each door to corridor, control 24-volt r
in corridor boxes. 277-volt light circuits, run to same
are turned ON and OFF by relays.

How Remote-Control Wirin changes and maintenance i

Flush relay boxes near corridor ceiling, are inconspicuous yet easily accessible. They simplify routine maintenance as well as switching changes.

G-E Remote-Control Wiring is used in 10-story administration building of huge new Baltimore home for Bureau of Old-Age and Survivors Insurance.



make switches control different lights,
itenance man simply changes terminal strip connec-
; between the General Electric Remote-Control relays
switches, in proper box.

In minutes, he makes the conversion, from corridor — without new wires—without cutting holes—without interrupting office work. He doesn't even have to enter a room.

owers the cost of partition he Social Security Building

Administration building of the
reau of Old-Age and Survivors
urance in Baltimore, Maryland, was
igned to provide maximum flexi-
ty of office space. Each typical floor
a permanent central corridor run-
g the length of the 10-story building.
ce space on either side of the corri-
is sub-divided by movable metal
titions.

flexible system of lighting control
s needed in order that partitions
ld be relocated as required, without
ensive construction or interruptions
to provide each office with its own light switch.

The photographs and captions on these pages show how General Electric Remote-Control Wiring was installed to meet this requirement of complete flexibility. For further information about this installation — or for other ideas that can help you to cut costs of partition changes and maintenance with General Electric Remote-Control Wiring — write to General Electric Company, Wiring Device Department, Providence 7, Rhode Island.

Progress Is Our Most Important Product

GENERAL ELECTRIC

General Management
of design and construction
for Social Security Building:
General Services Administration

Associated Architects:
Meyer and Ayers, Fisher, Nes,
Campbell and Associates

Mechanical, Electrical and Civil Engineers:
Whitman, Requardt,
and Associates

Structural Engineer:
Van Rensselaer P. Saxe

General Contractor:
McCloskey and Company

Electrical Contractor:
The Howard P. Foley Company

FROM MANUFACTURERS OF CONDUIT SINCE 1910...

Electrictube®

THIN WALL STEEL

CONDUIT

- Uniform Gauge
- Accurate Diameters
- Bends Easily
- Easy to "Fish"
- Won't Kink . . . Won't Flatten
- Speeds Job, Saves Money

"ELECTRICTUBE" EMT Steel Conduit has long been a favorite of contractors because of its outstanding quality and features. Satin-finished, electro-galvanized exterior provides exceptional corrosion-resistant life. Super-smooth interior enameled-finish permits easy feeding, pulling around bends and re-feeding wire without strain or effort. U/L approved, meets Fed. Spec. WWT 806b. See your local distributor or write Clayton Mark for free literature.

Distributed in all 50 states and throughout the world

CLAYTON MARK
& COMPANY
1900 DEMPSTER STREET · EVANSTON, ILLINOIS · U.S.A.

PUMPS · WATER WELL SUPPLIES · CONDUIT · UNIONS · TUBING

4545

WIREMOLD®
ELECTRIC IDEAS

PREPARED EACH MONTH FOR ELECTRICAL CONSTRUCTION AND MAINTENANCE
TO BRING IDEAS, NEWS AND HELPFUL INFORMATION TO ELECTRICAL MEN

62nd YEAR

NOVEMBER 1961

RACEWAYS AND INSTITUTIONS .... FIRST PAGE
CODE COMMENTS .... FIRST PAGE
EDITORIAL .... SECOND PAGE
PRODUCT OF THE MONTH .... SECOND PAGE
QUIZ CORNER .... SECOND PAGE
COUPON FOR FREE ITEMS .... SECOND PAGE
PERSONNEL AT MEETINGS .... THIRD PAGE
GROUND TO GROUND .... THIRD PAGE
ENGINEERED SPECIALS .... FOURTH PAGE
USEFUL LITERATURE .... FOURTH PAGE
WORTH READING .... FOURTH PAGE
PRACTICAL TIPS .... FOURTH PAGE

Raceways Give Needed Flexibility For Institutions

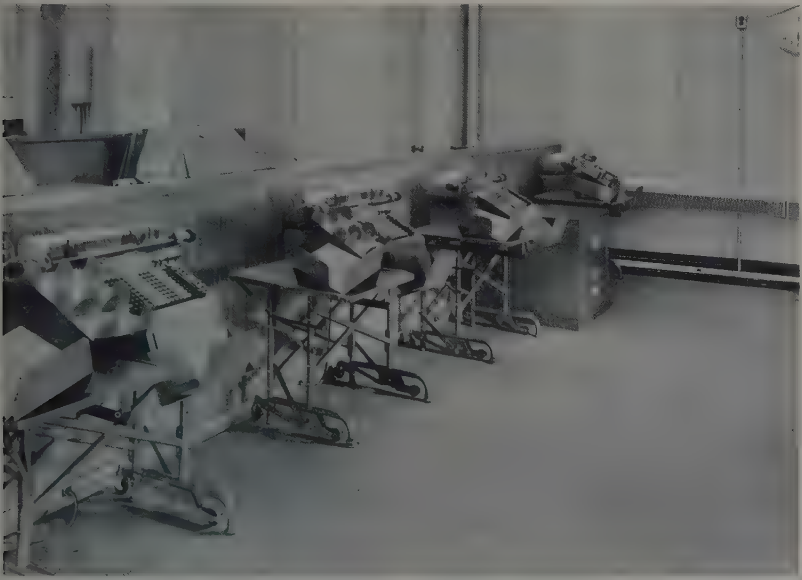
Modern concepts of wiring required by rapidly-changing atmosphere of service organizations

Service-type institutions, such as banks, hotels, churches and hospitals, are turning more and more to surface wiring systems — for both remodeling and new construction — because of the flexibility this technique provides.

Where the rate of business growth is unpredictable, as in banks, it often is advisable to use the movable partition approach to divide office and work areas. The building-in of Plugmold® provides a simple method of obtaining "instant outlets" when the partitions are moved and rearranged.

Hotels re-wiring for air conditioning find surface systems the most effective, economical and unobtrusive method of bringing in the needed power. Another advantage is that, because of the reduced amount of wall breaking, redecorating is not a serious problem.

continued on third page



BANKS find the convenience of multi-outlet strips of great aid in using electrically-powered machines. The strips also add flexibility when movable partitions are used.

Code Comments

Grounded vs. Grounding

Q. *What is the difference between a grounded conductor and a grounding conductor?*

A. In Article 100 — Definitions, the NEC defines these as:

"Grounded Conductor: A conductor which is intentionally grounded, either solidly or through a current limiting device.

"Grounding Conductor: A conductor used to connect an equipment, device or wiring system with a grounding electrode or electrodes."

Emergency Circuit Loads

Q. *What loads are supplied from emergency circuits?*

A. Article 700, Section 13 states: "No appliances and no lamps, other than those specified as required for emergency use shall be supplied by emergency lighting circuits."

Separate Emergency Circuits

Q. *Is it permissible to install emergency circuits in same raceway with other circuits?*

A. According to Article 700, Section 17: "Emergency circuit wiring shall be kept entirely independent of all other wiring and equipment and shall not enter the same raceway, box or cabinet with other wiring except:

Exception No. 1. In transfer switches.

Exception No. 2. In exit or emergency lighting fixtures supplied from two sources."

WIREMOLD®

Advertisement

Editorial

Be proud of your appearance

The craftsman in any field takes pride in the finished appearance of his work. This is only proper because it is by the looks of the job that we are judged.

But pity the poor electrician. If he installs in-wall wiring, the most important part of his work is forever buried — except, perhaps, to another electrician. A wall plate is all he leaves for others to see.

However, the electrician who takes pride in his work, who takes that extra moment of thought to assure a better installation, is unhappy to have his work hidden.

He is the one who chooses Wiremold systems, both for the electrical advantages and because they form a showcase for his work.

Product of the Month

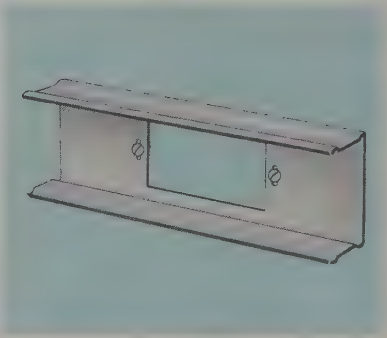
New fitting simplifies feeding Wiremold 3000 from wall box

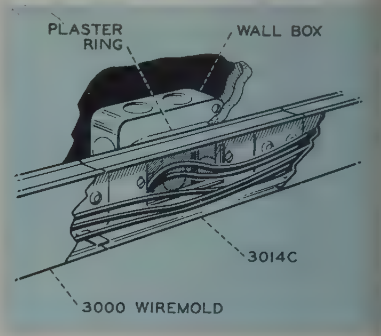
The growing use of Wiremold 3000 in Tele-Power systems has created a demand for a fitting which would simplify tying in a flushed-in wall box to Wiremold 3000.

To answer this need, Wiremold engineers have developed the 3014C.

This fitting, 8-in. long, is provided with a rectangular holecut to fit the opening of a single-gang box.

This new part provides an effective means of going from the box to the back of 3000. It is listed by Underwriters' Laboratories.





Quiz Corner

Questions for this department are taken from inquiries received from the field. Your questions are welcome; indeed, they are necessary if this department is to serve you with worthwhile information. Address: Quiz Corner, The Wiremold Company, Hartford 10, Conn.

Q. *What is the meaning of the middle label on page 6 of Catalog 22?*

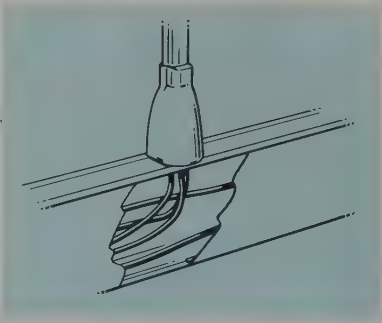
A. This is the Underwriters' Laboratories Reexamination Marker which covers those items which are periodically inspected by Underwriters' Laboratories at the manufacturer's plant under their Reexamination Service — in our case, fittings. Items covered by this Reexamination Service need carry no Underwriters' label, but Wiremold does show this marker on the carton labels of all items so listed by Underwriters' Laboratories.

Q. *I would like to use a 21SW96 Slimline Unit for a high output lamp. Can this be done?*

A. Wiremold can furnish such a unit on special order.

Q. *Is there an effective means for connecting 500 Wiremold to the side of 3000 Wiremold?*

A. Yes. Cut hole in the side of the 3000 and use a 5785 Combination Connector.



Q. *In the capacity chart for No. 3000 you say that thirty No. 14 Type T or TW wires can be installed without devices in the raceway. What happens when I have a job where I need to install a total of forty-five such wires but twenty of these are control wires? Is this a permissible installation?*

A. Yes, new UL listing noted in the May issue of *ELECTRIC IDEAS*, shows No. 3000 for use with up to fifty-six No. 14 conductors.

Q. *Is it possible to purchase parts for various Wiremold fittings, such as the base, cover, or screws?*

A. Yes. Specify the parts by name when ordering.

WIREMOLD ■ HARTFORD 10, CONN. E1-11

Gentlemen: Please send free the checked items

NAME ______

COMPANY ______

ADDRESS ______

______

☐ Contractors' Electrical Equipment reprint
☐ Advertising Mats
☐ Electric Ideas, October 1961
☐ Electric Ideas, September 1961
☐ Wiring Guide (Catalog 22)

WIREMOLD®

Advertisement

aceways Give Needed Flexibilty

continued from first page

:HURCH lounge is better able to handle its ole as activities center with Plugmold strip providing plenty of receptacles for lamps, appliances and audio-visual aids.

In hospitals, of course, the applications for surface systems are legion. It is not unusual, for example, to find Wiremold systems being used for exit lighting, nurses' call systems, emergency lighting and for normal power installations as well as in the laboratories.

With the growing use of church lounges as an activities center, many churches have turned to Plugmold to provide plenty of conveniently-located receptacles for lamps, audio-visual aids, and other appliances.

The flexibility of surface systems in providing for lighting has been effectively used by museums and art galleries, as well as by virtually every type of commercial and industrial establishment.

POWER for air conditioning is brought to the rooms of this hotel by means of ceiling-mounted Wiremold 3000.

MUSEUMS find the flexibility of surface systems ideal for power and lighting. This museum, located in an old mansion, used raceways to avoid unnecessary wall breaking which would have destroyed paneling and required extensive re-decoration.

Personnel at Meetings

Since the end of September, Wiremold personnel have been active in seven industry expositions in various parts of the country. In all, 12 Wiremold representatives have taken part, underlining our sincere belief in the value of this type of meeting. In fact, Wiremold representatives are urged to take part in industry sessions whenever their presence will aid in a better understanding of surface systems.

Next month, Vic Meier and Sam Page, who become numbers 13 and 14, handle honors at the AVA convention in Kansas City.

Vic Meier

Sam Page

Show details are:

AVA Convention (American Vocational Assoc.) — Municipal Auditorium, Kansas City, Mo., Dec. 4-8.

Ground to Ground

Each month we ask a question which, when answered, will help us improve our products and services to you. A frank answer will be appreciated. Answers will not be published, but will be acknowledged. Address:

Ground to Ground
The Wiremold Company
Hartford 10, Conn.

Answers to last month's question on in-field improvisation brought out the fact that many contractors consider a certain amount of improvisation desirable. What is your favorite stunt on your most frequent improvisation? Why do you do it? Do you usually do it in your shop or on the job? Would you prefer to be able to buy the item?

WIREMOLD®

Advertisement

Engineered Specials

Special arrangement designed for DC use in laboratory

PROBLEM:

To provide a method of tapping into DC, with a choice of battery-supplied or rectified, in any one of a number of laboratories. The current is supplied from a central source in the basement and may be varied from 0 to 220 v.

SOLUTION:

A special Wiremold 3046 Cover Plate was developed to permit mounting in the 3000 raceway a ¾-in. deep plastic block containing four jacks.

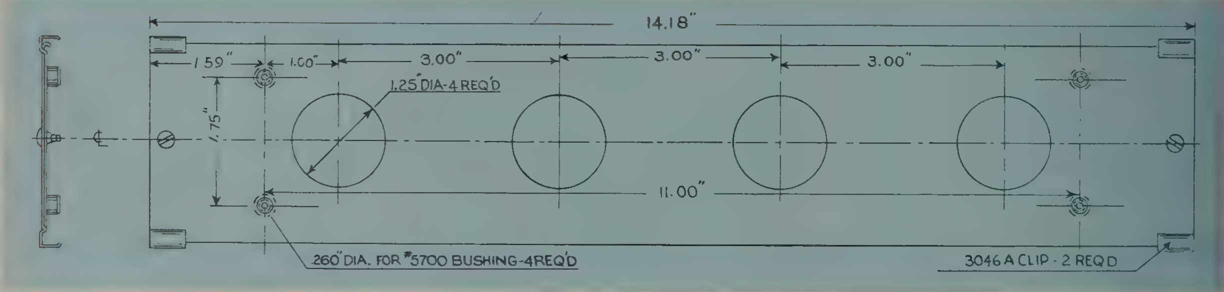
DISCUSSION:

The advanced physics laboratories at a major eastern university required a convenient source of DC power in the rooms of the multi-storied building. For purposes of economy, it was decided to install a patch board arrangement in the basement and feed the current into the laboratories, rather than to attempt to provide individual power sources in each room.

Because some of the experiments are so delicate, it was decided to install battery-supplied current to provide ripple-free power. For other experiments, rectified current was adequate, and this also was supplied to the patch board. A motor generator set was installed for recharging the 168 battery cells.

By changing the plugging arrangement on the main board, each room can select the voltage it needs from 0 to 220 v. DC, battery or rectified. Jacks are mounted in the special 3046 in two groups so that the lab worker knows which type current he is plugging into.

Wiremold engineers gladly accept the challenge of developing new products, or adapting existing ones, to help solve in-field problems.



Useful Literature

Check coupon on second page for copies of listed items.

Advertising Mats

A collection of a dozen advertising mats available without charge to electrical contractors. These are proven eye-catchers, laugh getters, and business builders. One and two column sizes.

Worth Reading

Check coupon on second page for copies of listed items.

Ancient Church Structure Modernized for Furniture Store, Contractors' Electrical Equipment, September, 1961. A description of an unusual wiring job which converted an old parsonage to a modern commercial establishment.

Practical Tips

Wiremold shears save time in cutting base and cover

Designed expressly to simplify the cutting of Wiremold base and cover sections, Wiremold shears save up to one-third the time normally used to cut these parts.

Two shears are available, the 620 for Wiremold 2000 and the 622 for Wiremold 2200. Both are furnished with a detachable 30-in.-long handle and attached (by means of four flat head screws) to a block of wood. It is simple to detach the shear from the wood if it is desirable to mount to a bench.

Easily portable, the Wiremold shears save time even as they assure a clean, burr-free cut.

WIREMOLD®
HARTFORD 10, CONNECTICUT

All WIREMOLD products are sold through electrical distributors — your best source for all electrical products.

Advertisement

NO ADHESIVE PICK-OFF!

Bull Dog PLASTIC ELECTRICAL TAPE

You get full adhesive power — where you want it — with Bull Dog Vinyl Plastic Tape. The adhesive is anchored to the face by a special process. It does not pick off, no matter how you handle the tape. This means Bull Dog Vinyl Plastic Tape sticks fast, stays tight.

And you do twice the work in half the time because Bull Dog Vinyl Plastic Tape does the work of both rubber and friction tape. Available in 60 and 66 ft. rolls and the variety of widths and lengths you require. Low bulk especially good for close tolerance work. Approved by Underwriters' Laboratories, Inc.

There's a BULL DOG TAPE for every purpose
- *Friction*
- *Plastic*
- *Rubber*

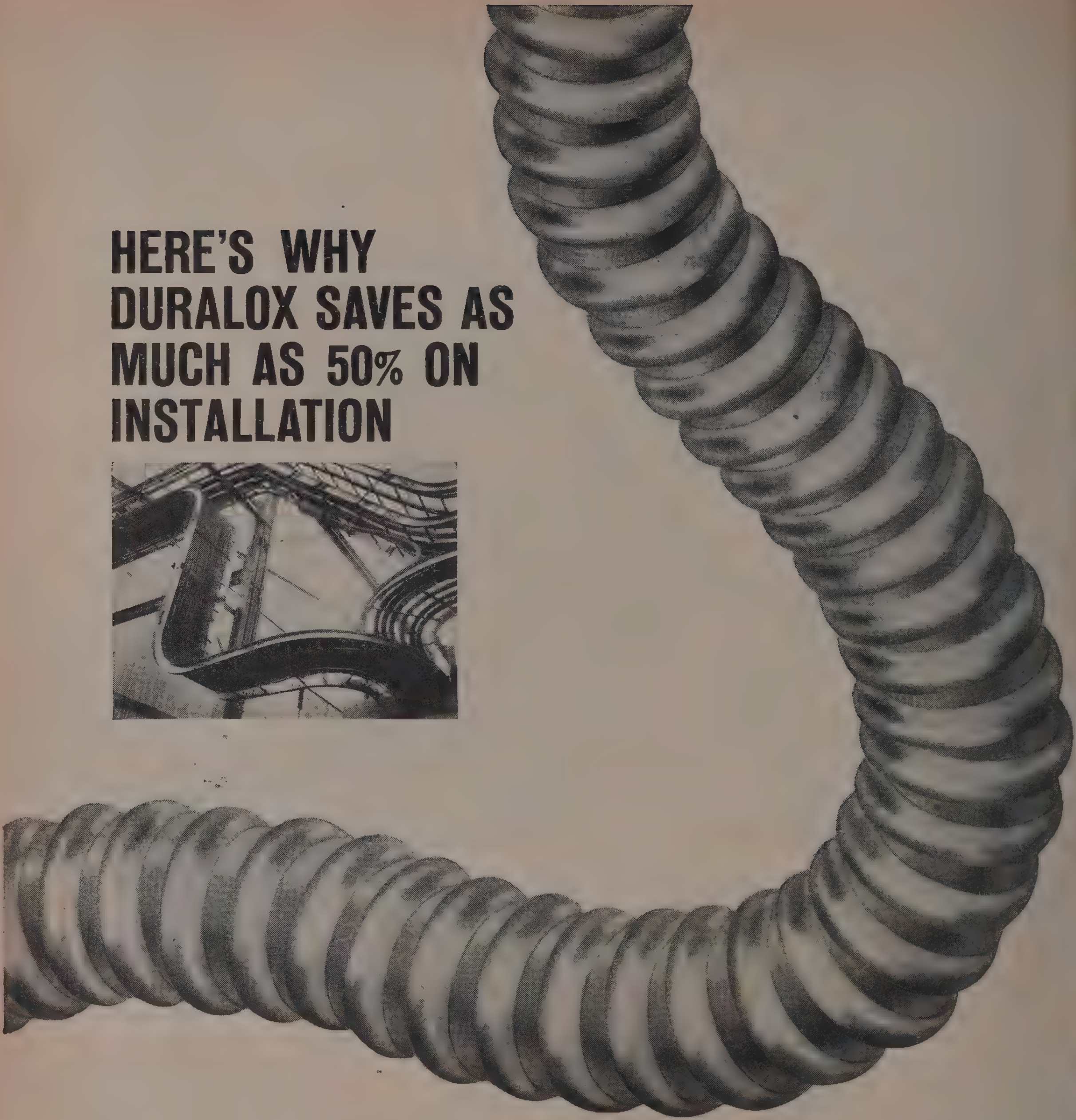
Sold only through verified wholesalers.

AMERICAN BILTRITE RUBBER COMPANY
BOSTON WOVEN HOSE & RUBBER DIVISION
BOSTON 3, MASSACHUSETTS

BOSTON

Also manufacturers of Matting, Stair Treads, Automotive Hose, Garden Hose

HERE'S WHY DURALOX SAVES AS MUCH AS 50% ON INSTALLATION



Duralox* needs no conduit—saves time, money, manpower. Duralox is already enclosed in durable, yet flexible, metal armor. Thus, it can be installed *without* conduit—in long runs over and around obstructions, in trays, indoors or out.

You're in—and out—of plants quicker. Make the most efficient use of available manpower.

For your clients—Duralox is easily moved and 100% salvageable—makes their entire plant operation more flexible—a valuable selling plus for you.

And Duralox's lower reactance in higher voltages—because of the close spacing of conductors—results in reduced voltage drop and more efficient power distribution.

Anaconda Duralox Cable is available in all popular sizes and voltages—copper or aluminum conductors with rubber, plastic or varnished-cloth insulation.

Talk to the Man from Anaconda about Duralox for *your* future jobs.

For full information on Anaconda Duralox Cable, write for Bulletin DM 5606 to Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York, Dept. **EFL-1-ECM.**

*Reg. U. S. Pat. Off. 61261C

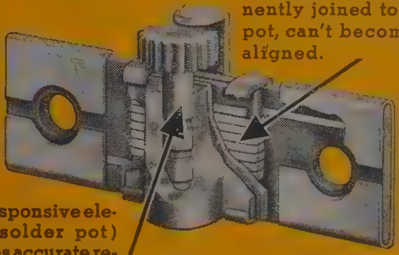
Duralox has Anaconda Butyl (AB) rubber insulation
for • extra-high resistance against ozone
• exceptional moisture resistance
• 22% more current-carrying capacity than 70° centigrade insulation

SEE THE MAN FROM
ANACONDA®
FOR BUTYL-INSULATED
DURALOX POWER CABLE

ONLY SQUARE D STARTERS WITH 1-PIECE OVERLOAD RELAYS GIVE *Absolute* PROTECTION!

• Only Square D makes thermal overload relays with 1-piece construction—and only with 1-piece construction can you *know* you've installed the heater correctly. Square D 1-piece overload relays can be installed only one way. They are factory-assembled, individually tested and calibrated, completely tamper-proof. Repeated tripping will not affect accuracy.

You *pay* for overload protection—be sure you *get* it. Insist on Square D 1-piece overload relays for *absolute* protection.

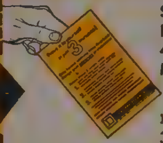


Heat-producing element is an integral part of overload unit. It's permanently joined to solder pot, can't become misaligned.

Heat-responsive element (solder pot) provides accurate response to overload, yet prevents nuisance tripping.

D EXCLUSIVE—
1-piece Overload Relay
for *ABSOLUTE* Protection!

Mail coupon today for simple "jig-saw" demonstrator—see why only Square D gives absolute protection



Square D Company
Department SA-223
4041 North Richards Street
Milwaukee 12, Wisconsin

Please send me information on Square D magnetic starters, along with your simple 3-minute "jig-saw" demonstrator

NAME________________________________

COMPANY________________________________

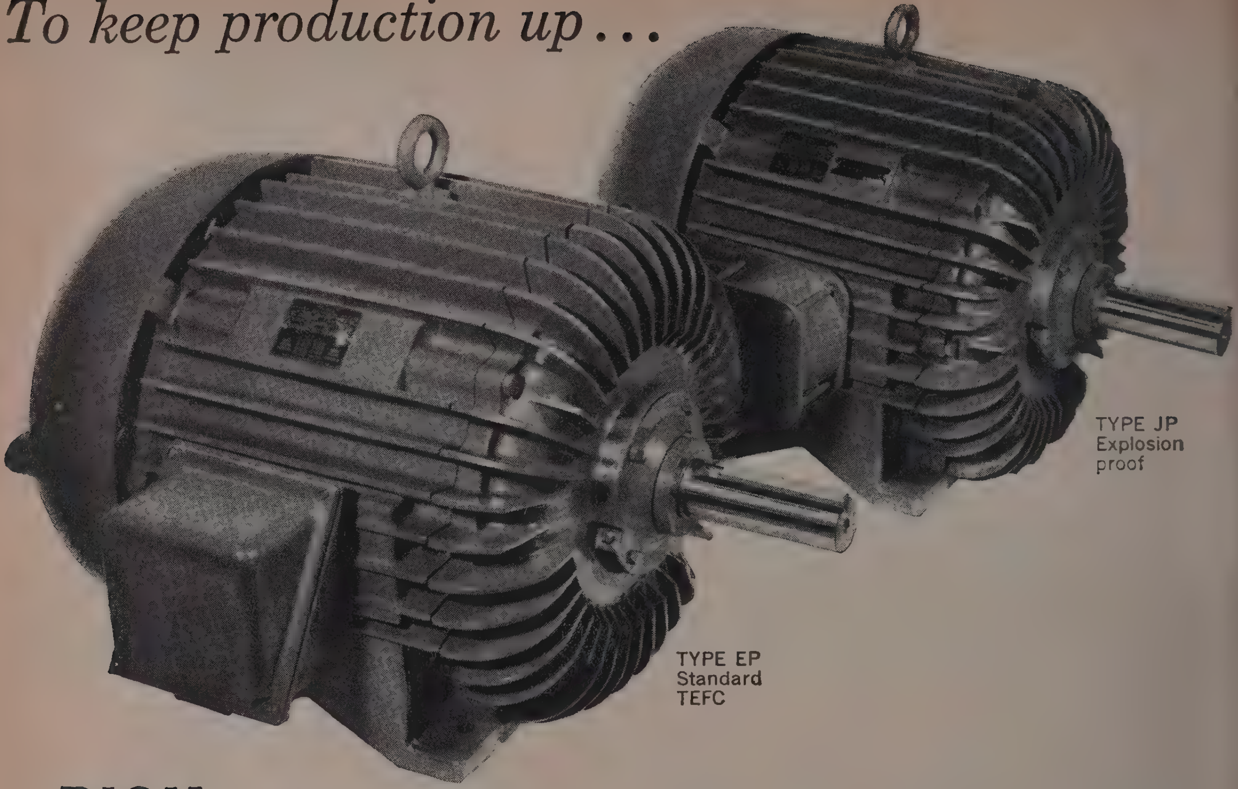
ADDRESS________________________________

CITY________________ZONE____STATE__________

SQUARE D COMPANY

wherever electricity is distributed and controlled

To keep production up . . .



PICK FROM THIS PROTECTED PAIR...

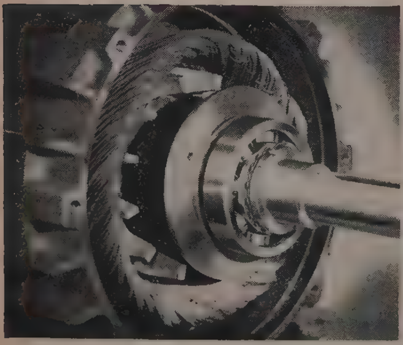
Here's a power-packed pair of Wagner® totally-enclosed fan-cooled motors —Type EP, standard, protected against damage from dust, abrasive, fumes, steel chips or filings; and Type JP, explosion-proof, for safe use in specified hazardous locations.

They'll keep your production rates up, delivering full rated horsepower under the toughest conditions . . . staying on the job with dependable, continuous service that means peak output. They're the perfect pick, for individual machines or for automated lines.

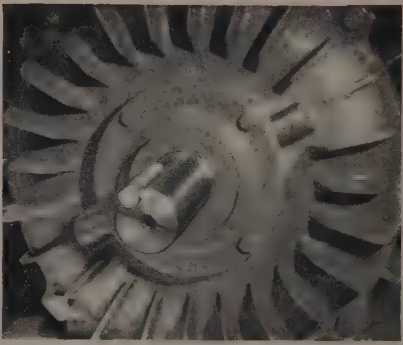
In the design illustrated, these motors are built in ratings through 100 hp in NEMA frame sizes 182-445U. Let your Wagner Sales Engineer show you how this protected pair (or larger Wagner enclosed motors through 500 hp) gets the job done. Call him, or write us for Bulletin MU-224.

Wagner Electric Corporation
6413 PLYMOUTH AVENUE, ST. LOUIS 33, MISSOURI

WM60-19



HEAVY-DUTY BALL BEARINGS . . . The ball bearings used in these motors are of the highest quality, with more than ample capacity to provide long, troublefree service under heavy loads.

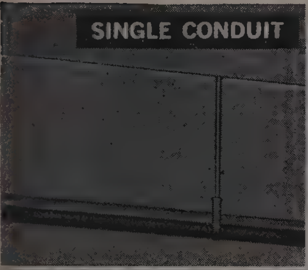


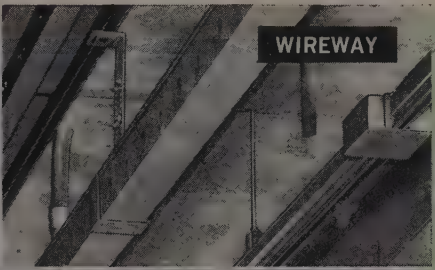
BEARINGS CAN BE RELUBRICATED . . . Factory lubrication will last for many years under normal service, but openings are provided to permit relubrication that adds years to motor life under severe conditions.

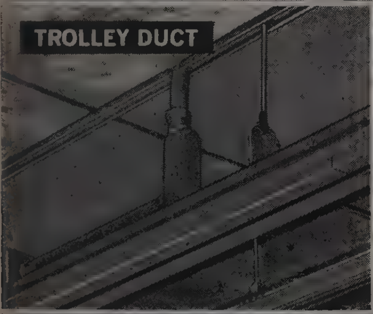
SECURELY SEALED FOR LOW MAINTENANCE . . . Both ends of these motors have running shaft seals to keep the bearings clean. Bearing housings are effectively sealed to prevent escape of grease.

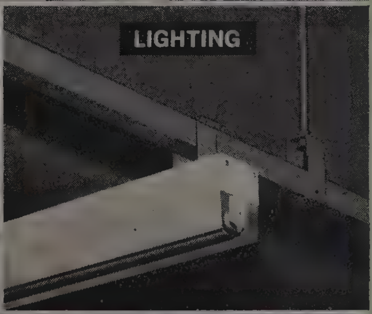
All-Around Performer at the Civic Arena…

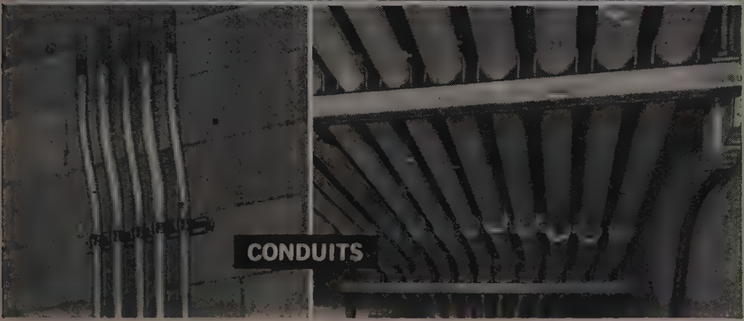
WHERE NEARLY EVERYTHING BUT THE RETRACTABLE ROOF HANGS FROM STEEL CITY CHANNELS



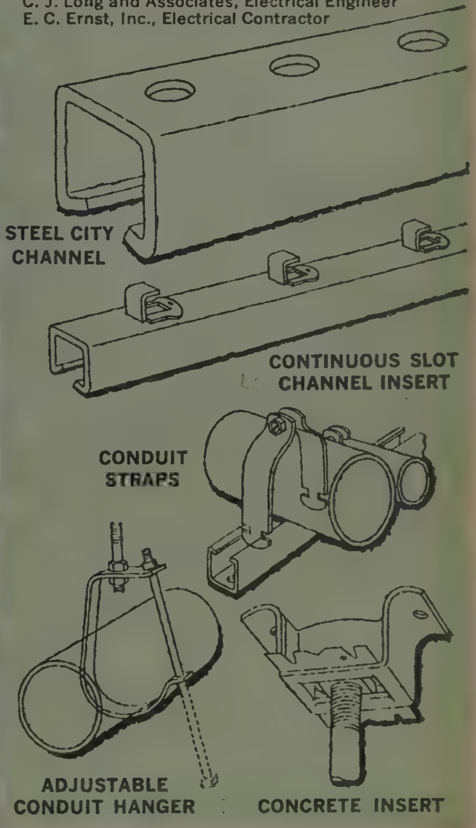








Public Auditorium Authority of Pittsburgh, Owner
Mitchell & Ritchey, Architects
C. J. Long and Associates, Electrical Engineer
E. C. Ernst, Inc., Electrical Contractor



—PLUS AN "ALL-STAR" SUPPORTING CAST

STEEL CITY ELECTRIC COMPANY PITTSBURGH 33, PA.
Subsidiary of American Marietta Company

LIKE to generate a bigger share of new electrical contracts? Have a feeling you're missing good opportunities to bid? Like to uncover more jobs that are "tailor-made" for you...when and where you want them? You need daily Dodge Reports !!

DODGE REPORTS are individual building project reports. They're mailed to you daily. You get REPORTS on just the types of building you're interested in – in the area where you do business. They tell who's going to build what and where . . . whom to see . . . when bids are wanted . . . who else is bidding . . . who gets which awards.

When you use DODGE REPORTS, you always know what's coming up. You don't depend only on invitations to bid. You concentrate on jobs you *know* will be profitable.

If you do business anywhere in the 37 Eastern states, you need DODGE REPORTS.

SEND FOR THIS FREE BOOK

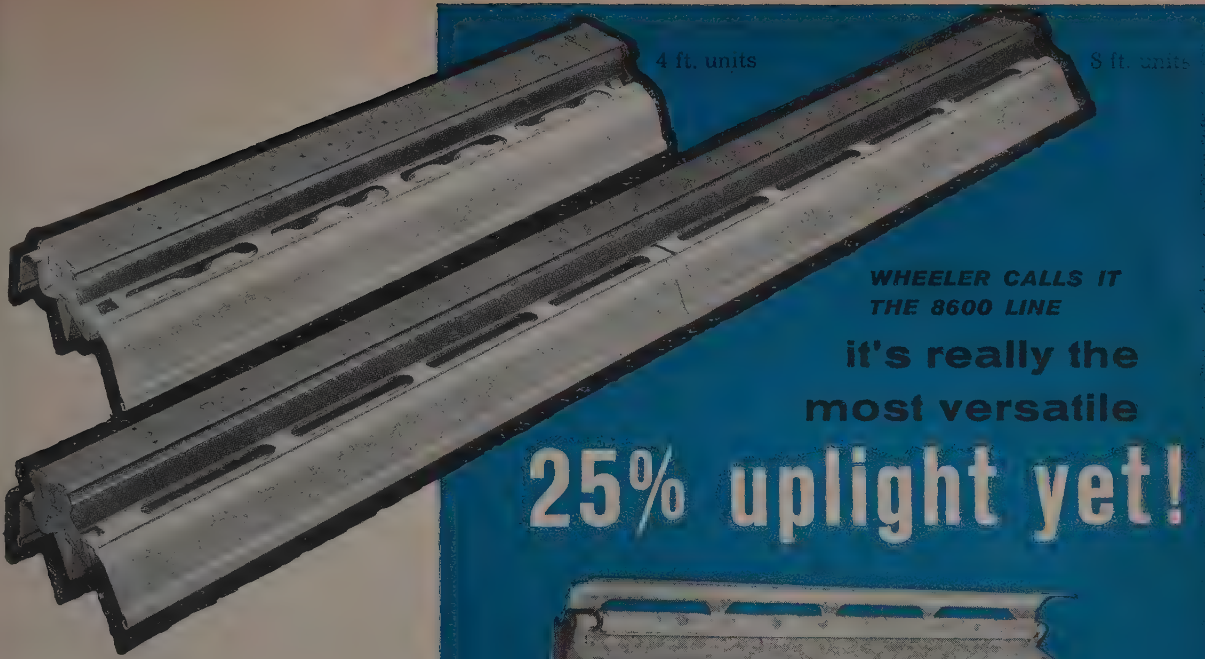
F. W. Dodge Corporation, Construction News Division
119 West 40th Street, New York 18, N. Y., Dept. ECM111

Send me the book: "How Subcontractors Get More Work in New Construction" and let me see some typical Dodge Reports for my area. I am interested in the general markets checked below.

☐ **House Construction** ☐ **General Building**
☐ **Engineering Projects (Heavy Construction)**

Area________________________
Name________________________
Company________________________
Address________________________
City____________Zone______State______

F. W. DODGE
CORPORATION
Dodge Reports
HELP
ELECTRICAL CONTRACTORS
GET MORE BUSINESS



WHEELER CALLS IT THE 8600 LINE

it's really the most versatile

25% uplight yet!

Here are some of the Features . . .

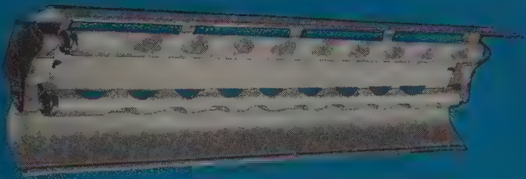
Wherever 25% uplight is desired, Wheeler has the answer. The reinforced uplight diffuser slots are turned up to provide better light distribution (as shown by the smoke demonstration photo). The "chimney effect" promotes self-cleaning action and enables the cooler lamps to give a greater light output. Particular attention has been given to the shielding angles which exceed those usually available for industrial type fixtures.

The fused porcelain enamel reflectors have their edges *turned in.* This exclusive Wheeler design prevents the dust, lint and moisture collection common to all fixtures with "out-turned edges".

All Series 8600 units are available with Slimline, Rapid Start Bi-Pin, 800 and 1500 ma lamps. Plastic prismatic lenses, louvers and wire guards are among accessories offered.

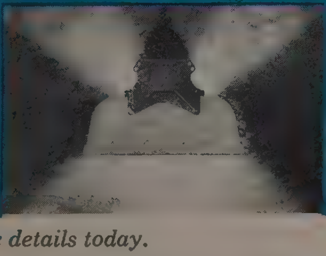
Wheeler's recognized quality features make the 8600 Line the ideal fixtures for the engineer to specify, the contractor to install and the owner to maintain. For complete details send for the new four-page color brochure.

"V 25" fixtures have "V" type reflectors providing 30° crosswise shielding and 22% uplight.



"F 20" fixtures have flat reflectors providing 15° to 18° crosswise shielding as well as uplight.

"P 30" fixtures employ a plastic "Krystalens" which offers almost total lamp shielding while utilizing the uplight feature.



The superior light distribution and shielding of the Wheeler 8600 Line is dramatically shown in this smoke demonstration test.

Send for complete details today.

WHEELER REFLECTOR

Company • Division Franklin Research and Development Corp.
MAIN STREET, HANSON, MASSACHUSETTS

Electrical Protection goes MODERN with BUSS Fuses . . .

at Sandusky Foundry & Machine Co.

Sandusky, Ohio

THIS ALL FUSE INSTALLATION PROVIDES NEEDED HIGH INTERRUPTING CAPACITY—AND SAVED AN ESTIMATED $20,000

A new electrical system was installed at the Sandusky Foundry and Machine Co., to feed a 1000 KVA annealing furnace and plant feeders and sub-feeders.

The engineers at Universal Marine Construction Co., Sandusky, Ohio who designed and installed the job, estimated the available fault current would be in the neighborhood of 75,000 amperes.

To be sure of obtaining the needed safe and dependable protection BUSS Hi-Cap and FUSETRON dual-element fuses were installed.

DEPENDABLE PROTECTION AT A $20,000 SAVING

Including the cost of fuses and switches, an estimated $20,000 was saved over what it would have cost to use mechanically operated devices with an interrupting rating of only 75,000 amperes.

This BUSS and FUSETRON fuse installation also permitted the electrical system to be co-ordinated, so outages on feeder and sub-feeder circuits can be limited to the circuit on which trouble occurs.

ELECTRICAL SYSTEM NOT DISTURBED WHEN TRANSFORMER CAPACITY WAS INCREASED

Shortly after the original installation, additional transformer capacity was added,—bringing the available fault current to approximately 150,000 amperes.

No change in the main service panels was needed, however, as the 200,000 amp. interrupting capacity of BUSS Hi-Cap fuses is still adequate to assure safe protection.

Neither was a change required in the protection of feeder circuits because FUSETRON fuses have adequate interrupting capacity to safely handle any fault that might occur on them.

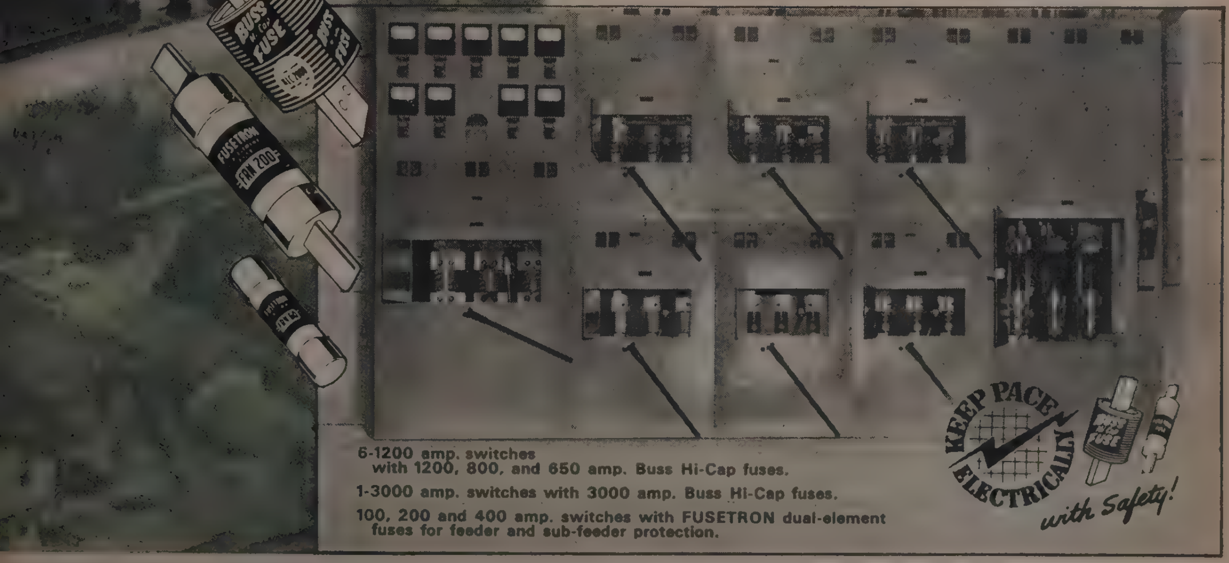
SAFE PROTECTION REMAINS SAFE

After years of inactivity, BUSS Hi-Cap and FUSETRON fuses provide the same safe, accurate protection if called upon to open as they would on the day installed. Dust, fumes, corrosion or age cannot increase the capacity of fuses or lengthen their blowing time.

For more information on how to select the proper fuse, write for the new BUSS booklet . . . *Basic Protection for Electrical Power Systems.*

BUSSMANN MFG. DIVISION, *McGraw-Edison Co.,* **ST. LOUIS 7, MO.**

1161



6-1200 amp. switches with 1200, 800, and 650 amp. Buss Hi-Cap fuses.

1-3000 amp. switches with 3000 amp. Buss Hi-Cap fuses.

100, 200 and 400 amp. switches with FUSETRON dual-element fuses for feeder and sub-feeder protection.

Another new development using

B.F.Goodrich Chemical ***raw materials***

New THW wire insulated with Geon is used in sizes up to 3/0 AWG at this new Sohio plant. Wire is made by the Paranite Wire and Cable Division of the Essex Wire Corporation, Marion, Indiana. B.F.Goodrich Chemical Company supplies the Geon vinyl.

"We welcome the higher factor of safety"

. . . of new THW wire insulated with GEON vinyl

These pictures show new wiring going into the Sohio Chemical plant at Lima, Ohio. Here's what the contractor, W. W. Clark Corporation of Cleveland has to say about it:

"In a chemical plant or refinery, electrical wiring often has to go near processing equipment that operates at high temperatures. We try to keep it at least a foot away, but sometimes have to go as close as 6". We welcome the higher factor of safety this new THW wire gives us."

Now you can add new heat resistance to the proved properties of insulation of Geon vinyl. Geon is tough, weatherproof and keeps its exceptional properties with age. It also resists oils, greases and chemicals.

For information about Geon wire and cable covering, or other ways that Geon improves products or opens new markets, write Dept. NO-7, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

Geon
VINYLS

B. F. Goodrich Chemical Company
a division of The B.F.Goodrich Company

B.F.Goodrich GEON vinyls • HYCAR rubber and latex • GOOD-RITE chemicals and plasticizers

look for this marking...

...and this tag
on every bundle

our assurance of top protection
gainst corrosion...
f faster and better conduit installations

he new SPANG Blue Star Galvanized Rig- Steel Conduit now has the regular hot-pped galvanized coating *plus* a second lvanized coating for extra protection gainst corrosion!

Threads are uniformly galvanized on ery ridge and valley for easy coupling. o excess zinc to chase off . . . no bare oots. It's the best thread protection availble against corrosion.

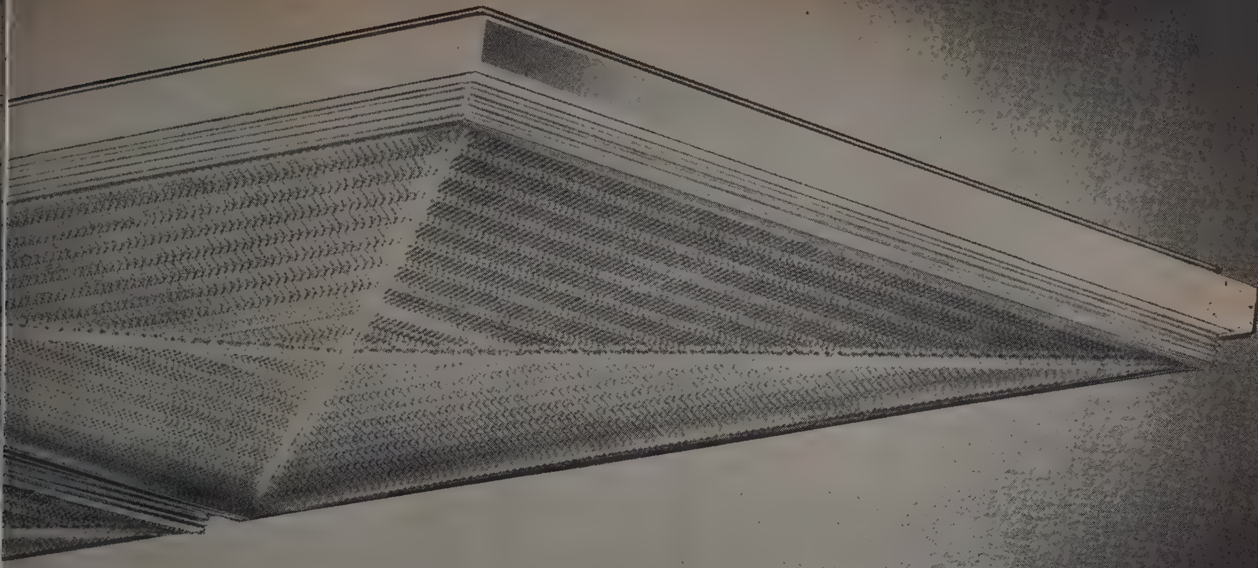
Double coating on the conduit inhibits ıst formation. Finish won't flake off. Prodes fine appearance in exposed locations.

Easier handling, too. SPANG Blue Star Conduit is bundled with steel strapping in sizes up through 1½". Shipped in one-ton lifts for fast handling by lift truck, easy inventory.

You owe it to yourself to try new SPANG Blue Star Conduit. Get complete details from your nearby SPANG Distributor.

SPANG Blue Star Conduit is one of the many fine products produced by *National Supply Division, Armco Steel Corporation, Two Gateway Center, Pittsburgh 22, Pennsylvania.*

ARMCO National Supply Division



A TRIUMPH OF LIGHTING FIXTURE DESIGN FROM DAY-BRITE

Introducing

TIARA

... the new measure of lighting quality
for offices, stores and schools

Just 3 $\frac{3}{16}$" slim! New Day-Brite TIARA provides a clean, modern look never before possible with a surface-mounted unit.

A distinctive glow around its wafer-thin frame softens brightness for high visual comfort, and gives the fixture a luminous floating appearance. Pure enchantment for any interior!

Precision *Pyramid* lenses create additional ceiling interest. There is no noticeable variation in surface brightness . . . no hot spots. Lighting quality is definitely Day-Brite.

For those who want the very finest, it's new Day-Brite TIARA . . . the crowning achievement in lighting fixture design. For complete information, contact your Day-Brite representative or write for free 8-page TIARA booklet. *Day-Brite Lighting, Inc., 6260 N. Broadway, St. Louis 15, Mo., and Santa Clara, Calif. In Canada: Amalgamated Electric Corp., Ltd., Toronto 6, Ont.*

DAY-BRITE

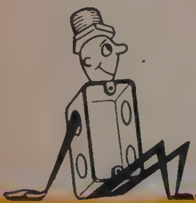
NATION'S LARGEST MANUFACTURER OF COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT

Lens by Holophane Co., Inc.

Exclusive New Plastic RACO Package saves time, uses less space

Fittings in plastic bags? That's right. Heavy duty, clear plastic bags are now carrying and holding—in place of inner cartons—Raco's most popular items. What a savings! You use less storage space. Quantities are smaller and geared to your more practical needs. Furthermore, fittings are completely protected from the elements.

Raco has the complete package that saves you time, helps you earn more. Prove it to yourself on your next job.



RACO

ALL-STEEL EQUIPMENT INC., Aurora, Illinois

61ST YEAR • NOVEMBER 1961

ELECTRICAL
CONSTRUCTION
AND MAINTENANCE

Fallout Shelters

In the event of a nuclear attack on the U.S., properly constructed and equipped shelters could save upwards of 80% of the population. Without shelter, it is doubtful that any modern industrial nation could survive as a significant political, economic or social force in the world. These are the brutal facts of life in this age of nuclear weapons.

Passive defense is an unpopular subject and such political poison that successive national administrations of both parties have skillfully dodged the issues it creates. Today hundreds, possibly thousands, of family type shelters are under construction. TV programs, magazine articles and newspaper features deal openly with the problems. The public is evidently now ready to face reality.

Emphasis on individually owned shelter facilities is obviously a temporary expedient. Anyone who has given thought to the subject at all must recognize that every-man-for-himself survival creates morally intolerable issues in our Western culture. As any shelter is better than none, family and factory shelters should be strongly encouraged but only as supplementary to a thoroughly planned community shelter program employing the very best of our engineering and military knowledge.

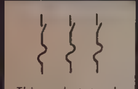
Capacity of the people to survive nuclear attack in vigorous good health, sound morale and disciplined social unity calls for a wholly different approach to shelter design than the frugal, primitive measures proposed in current civil defense pamphlets. Population survival and social recovery must be recognized as strategic counter-measures of top-priority military importance. Consequently, community shelters should provide not only ample accommodations for security against radiation hazards but should also provide fully equipped bases for an extended period of community recovery.

The cost will be huge but well within the capability of our economy and the capacity of the construction industry. Adequate, efficient and tenable shelter will not be built cheaply. Like nuclear submarines and missile bases, shelters must be equipped to serve a strategic military objective and to serve it effectively. And their purpose is to maximize population survival and speed community recovery.

Light, heat, cooling, air supply, water supply, waste disposal, radiation monitoring and communication will require an unusually sophisticated array of mechanical and electrical apparatus with fully reliable power supply. To maintain near-normal living conditions in shelters for an extended period of time in the presence of a lethal external environment is a major challenge to modern engineering and technology. But the threat of nuclear attack persists and one day we are going to have to face the realities and costs of survival.

Wm. T. Stuart

KNOW YOUR SYMBOLS



This symbol stands for fusible switch

This symbol stands for QUALITY

THE SAFETY SWITCH THAT CHALLENGES COMPARISON . . .

BullDog's general-duty safety switch!

- Minimum arcing—double break switching
- Arc control—Vacu-Break® principle
- Pressure contacts—Clampmatic® spring action
- Positive switching—direct handle operation
- Front operation—permits ganging

. . . plus, all current-carrying parts are silvered. Available in NEMA 1 and NEMA 3R enclosures . . . competitively priced. Challenge our distributors to prove these switches are the finest. Write for details!

BullDog Electric Products Division, I-T-E Circuit Breaker Company, Box 177, Detroit 32, Michigan. In Canada: 80 Clayson Rd., Toronto, Ont. Export Division: 13 East 40th St., New York 16, N. Y.

I-T-E CIRCUIT BREAKER COMPANY
BULLDOG ELECTRIC PRODUCTS DIVISION

ELECTRICAL
CONSTRUCTION
AND MAINTENANCE

WOODEN FORMS, made by the electrical contractor, were used to facilitate the job of laying out the grid of heating cable. These forms were fastened to the reinforcing steel along opposite edges of the area to be heated. As shown at right, the cable is looped around the semi-circular pieces which are firmly attached to the running board. The wing nut is used to adjust the top piece of wood on the semi-circle. The top piece is first swiveled out of the way to permit easy forming of the heating cable around the semi-circle. Then the top piece is swiveled back and locked in place with the wing nut to hold the cable in position. The semi-circular pieces have 3-in. radius and are spaced on 12-in. centers along the board. This arrangement keeps cable lengths 6 in. apart in the grid layout.

BUS TERMINAL USES . . .

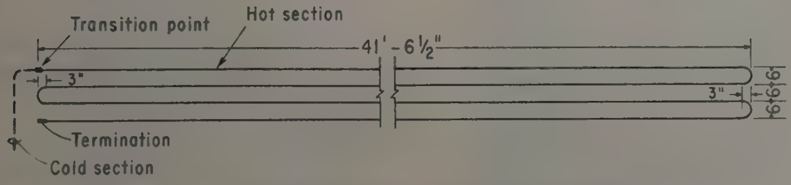
Electric Cables for Snow Removal

Design and construction of an electric heating cable system for snow removal from vehicle ramps at New York City's expanded Port Authority Bus Terminal.

By J. F. McPartland

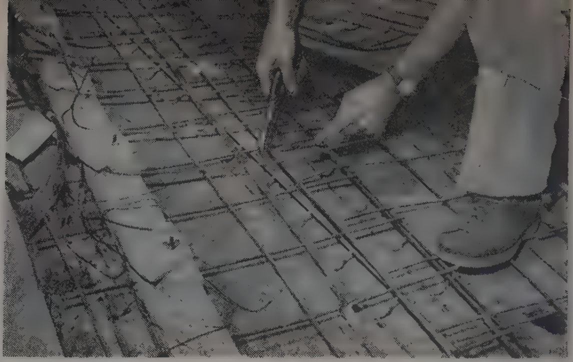
HERE at New York City's Port Authority Bus Terminal, electric energy—already a vital element of terminal operations—has been assigned a new task. Electrically powered heating cables will prevent accumulations of ice and snow on vehicle ramps exposed to the elements. Installation of this electric heating system is being made as part of the $20 million expansion of the terminal.

Modernization of the bus terminal was made necessary by greatly increased traffic demands on the facility. The existing roof of the terminal, formerly used as a parking area for 450 automobiles, is being converted to bus operations, supplementing the two other bus levels already in use. And a completely new superstructure is being added above the existing terminal to provide three levels of parking, with a capacity of approximately 1000 cars. As part of the task of designing ramps for these expanded bus and automobile facilities, careful consideration had to be given to the need for snow removal and prevention of icing during cold weather.

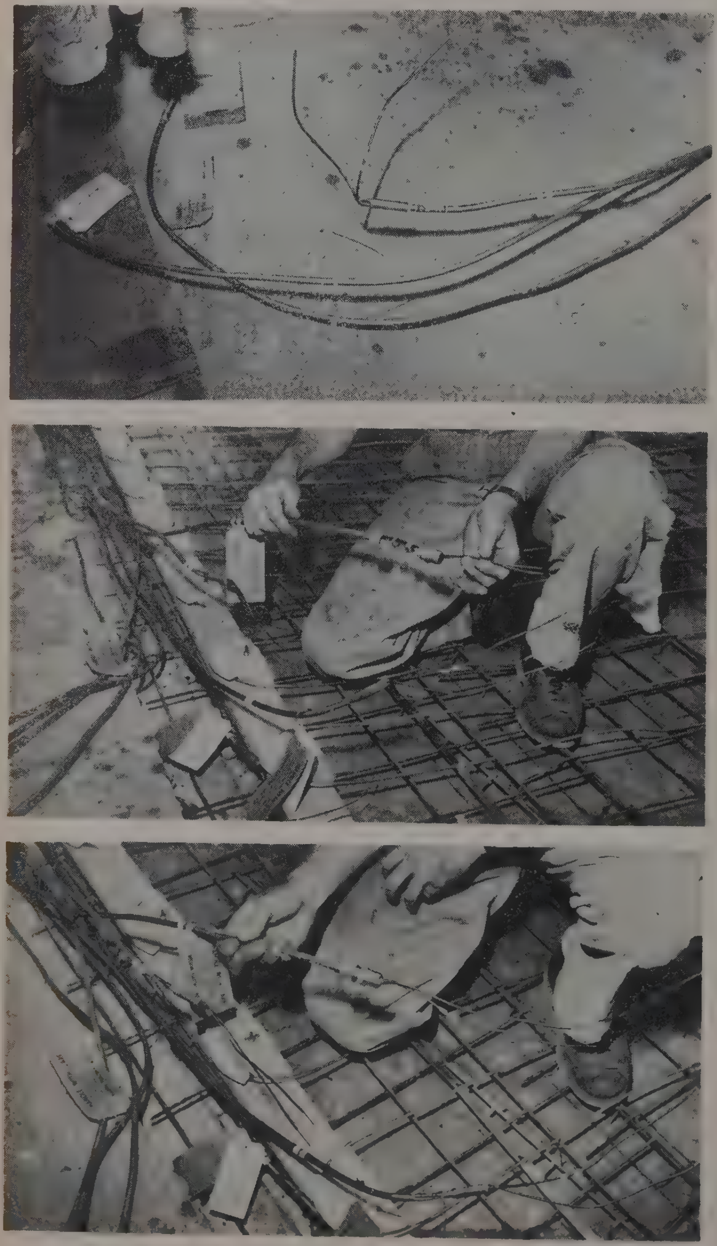


TYPICAL LAYOUT of one length of heater cable in the grid pattern.

CABLE LAYOUT was made simply and quickly by unreeling coil of cable in position on top of concrete reinforcing steel.



FIXED POSITION of all elements was assured by two methods. A copper strip running crosswise to the cable elements holds the cable under punched tabs, as shown. There are five strips laid out on 10-ft centers, perpendicular to the direction of cable runs. In addition cable elements were secured by bare wire to the reinforcing rods at 3-ft intervals along the length of the cable between the copper spacing strips.



PRE-FABRICATED CABLES were supplied with a cold section of MI cable spliced to the 168-ft length of heater element. At the supply end of the cold section, two No. 14 TW conductors emerge from a second splice joint. A special, ½-in. threaded, four-piece compression fitting is used to connect each cable to the deck box.

Construction

Accompanying photos and diagrams show a wide range of details of the heating cable installation on the old auto-parking level, now a new bus-operations level. The cable layout is made in the concrete deck immediately adjoining the entrance way from an outside ramp. The purpose of this installation is to melt any snow or slush which incoming busses might track into the area or which might be wind-blown into the area through the wide entrance openings.

As shown in the photos, the cable installation in the bus-level entrance way is made on top of the already existing concrete floor slab. The cable is set in a 4-in. thick, steel-reinforced concrete wearing surface poured on top of a ¾-in. thick waterproofing tar board on the old 8-in. thick slab. The cable is set in the middle of the 4-in. slab. The waterproofing layer greatly reduces heat conduction down—acting like an insulation—and what heat does get through the waterproofing tar will find the thermal resistance of the old 8-in. slab. The construction assures effective delivery of cable heat to the upper surface of the over-all slab.

Although not shown in these photos, the ramps for car movement between decks of the 3-deck parking area will be heated by elec-

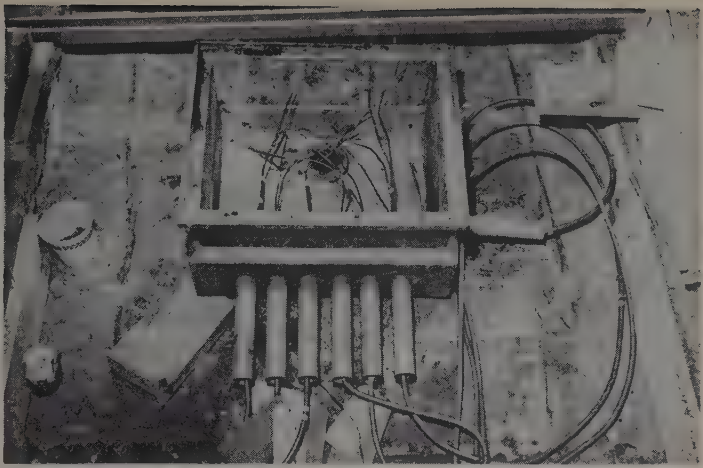
CAST DECK BOX is shown on its side with the supply circuit conduit coming into the bottom of the box. This conduit, in the installed position, passes through a hole in the slab and is connected to a run across the ceiling of the level below to the branch-circuit panelboard supplying the load.

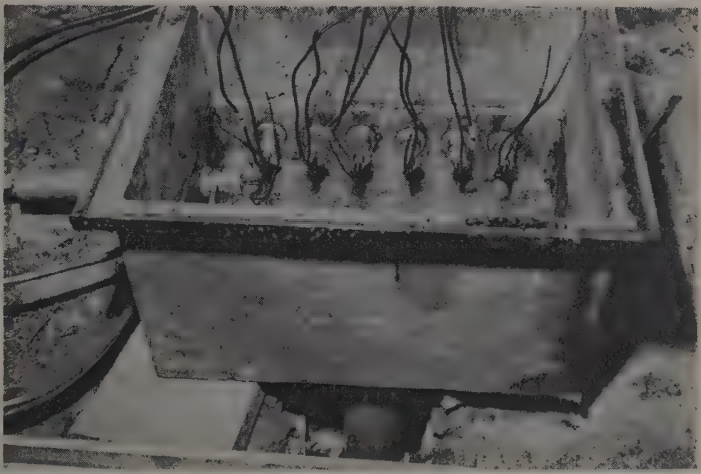
tric cables on a lightweight slab construction. These ramps are constructed of 4-in. thick, steel-reinforced, lightweight concrete. The cable will be laid out directly on top of these 4-in. slabs and covered with a 1½-in. thick wearing surface of asphalt, placing the cable about 1 in. under the top of the asphalt surface. In this position, the downward flow of heat by conduction is retarded by the relatively low thermal conductivity of the lightweight concrete aggregate. And this high resistance to down-flow of heat is important because of the low thermal conductivity of the asphalt covering. If the concrete slab had high conductivity it would dissipate too much heat through its bottom surface, reducing heat flow upward through the higher resistance of the asphalt.

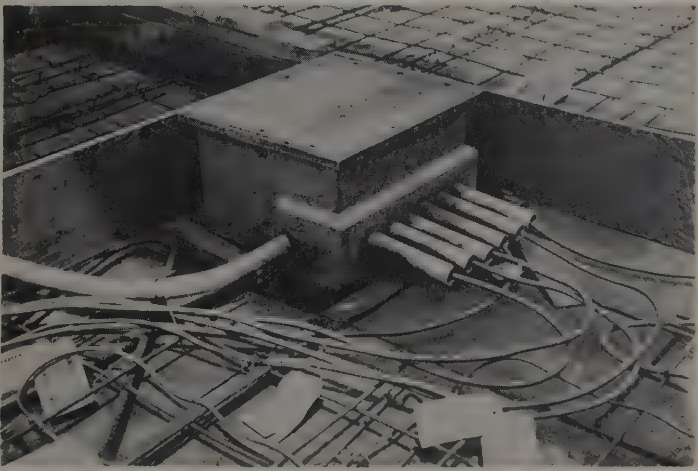
Cable Details

Layout and spacing of the heating cable was made to achieve a power expenditure of 40 watts per square foot of heated area. This load density has been found to be the average heat output required for snow removal in the Metropolitan New York area. Of course, for any installation, a wide range of specific job conditions can affect the required load density. But care should always be taken to assure adequacy in design loading.

Cable for this installation was provided by the manufacturer in pre-assembled lengths. Each 2-wire, mineral-insulated heating element is 168 ft long, with its two No. 18 wires spliced together at the end opposite the supply leads, and draws 14.8 amps. A section of "cold lead" was provided on each element







DECK BOX DETAILS show (at top) the use of short lengths of 1-in. conduit protecting the cable entries to the box against shearing forces between the box and the concrete. These boxes are set in concrete in this deck which will be subjected to the forces of continual bus traffic over them and the problems of concrete expansion due to temperature changes. Note the use of pipe sealing compound at the connections of the 1-in. pipe pieces to the tapped holes in the box. Inside the box (photo in center), compression fittings on the ends of the cable cold sections are threaded into 1-in. to ½-in. reducers which are, in turn, threaded into 1-in. tapped box holes. These connections are completely watertight. Photo at bottom shows a completed and covered box, set at proper elevation and ready for concrete pour.

CONSTRUCTION JOINTS in concrete slabs required looping of cable down into the soft layer of weatherproofing to accommodate any bending or shearing forces which might be set up at the joint. Here, the weatherproofing is being spot trenched along a construction joint, and each cable is deflected into a trench. Tar was poured over each trench to keep the small section of each cable in soft material where it crosses the joint, permitting movements which could be destructive to the cable if the cable were laid in concrete through the joint.

CAREFUL CHECKING for grounds, shorts and opens was an important phase of the over-all job. Here, a 1000-volt Megger is used to check from one conductor of a cable to the cast deck box. This was done for each cable. Complete testing was done before concrete pour, during pour and after the pour, to assure against any faulty conditions in the heating system.

to connect the supply end of the heating element to the circuit supply conductors in the splice box in the deck. This cold lead contains larger wires (No. 14) to minimize heat production and voltage drop in this section which serves only as a circuit home run. The length of each cold lead was pre-determined from the layout plan of the cable in the deck. An accompanying schedule shows the makeups of MI cable lengths for the bus-level layout.

A single, 3-phase, 4-wire supply circuit is run from a power panelboard to each floor box. All of the MI cables coming into each box are divided among the 3-phase conductors and the neutral. The heating elements are connected phase-to-neutral on the 480/277-volt circuit from the panel. Each element is rated at 300 volts, precluding use of the elements connected phase-to-phase on the 480 volts.

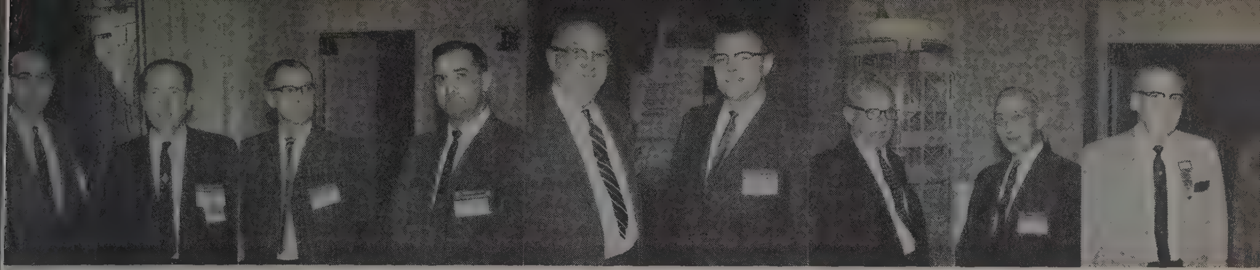
In use, the heating cable layouts will be energized manually upon forecast of snowfall. The mechanical piped hot-oil heating system used in the outside ramps is also activated to anticipate predicted snowfall. But with the electrical system, which has less thermal inertia (or less time delay), warm up periods will be considerably reduced, providing more accurate coordination with actual snowfall.

John Kyle is chief engineer of the Authority, and Joseph Fabian is engineer of design for this project. Design of the electric heating system was done by James H. Irwin, electrical engineer of the Authority. Installation was made by Hatzel and Buehler, Inc.

Heater Element Tabulation

Element No.	Connected to circuit No.	Hot section length	Cold section length
1 - 1	1 - φA	168 ft	7 ft.
1 - 2	1 - φA	168 "	9 "
1 - 3	1 - φA	168 "	12 "
1 - 4	1 - φA	168 "	13 "
1 - 5	1 - φB	168 "	18 "
1 - 6	1 - φB	168 "	20 "
1 - 7	1 - φB	168 "	20 "
1 - 8	1 - φC	168 "	5 "
1 - 9	1 - φC	168 "	8 "
1 - 10	1 - φC	168 "	10 "
2 - 1	2 - φA	168 "	3 "
2 - 2	2 - φA	168 "	4 "
2 - 3	2 - φA	168 "	6 "
2 - 4	2 - φB	168 "	7 "
2 - 5	2 - φB	168 "	9 "
2 - 6	2 - φB	168 "	10 "
2 - 7	2 - φC	168 "	12 "
2 - 8	2 - φC	168 "	15 "
2 - 9	2 - φC	168 "	10 "
2 - 10	2 - φC	168 "	29 "
3 - 1	3 - φA	168 "	4 "
3 - 2	3 - φA	168 "	5 "
3 - 3	3 - φA	168 "	4 "
3 - 4	3 - φB	168 "	4 "
3 - 5	3 - φB	168 "	6 "
3 - 6	3 - φB	168 "	8 "
3 - 7	3 - φC	168 "	10 "
3 - 8	3 - φC	168 "	11 "
3 - 9	3 - φC	168 "	10 "

CIRCUIT SCHEDULE for the heating layout in the deck of the new bus level shows how the 14.8-amp element loads are divided among 3-phase, 4-wire, 480/277-volt circuits from 3-pole, fused switches in a power panel. Circuits 1 and 2, for instance, each consist of four No. 4 RHW conductors in 1½-in. conduit, fed from a 3-pole, 100-amp switch fused at 90 amps. Loads are connected phase to neutral—277 volts. Circuit 3 is made up of four No. 6s in 1¼-in. conduit, fed from a 60-amp switch fused at 60 amps.



Sam Crain, Crain Electric Co., Amarillo, Tex.; Elmo Duke, Duke Electric Co., Inc., Amarillo, Tex.; T. R. Rawding, Rawding Electric Service, Inc., Beaver Falls, Pa.; A. P. Windisch, Slezah Electric, Aliquippa, Pa.; F. E. Wider, EMSCO Electric Corp., San Francisco, Calif.; W. W. Mohrdick, Mohrdick Electric Co., San Francisco, Calif.; Karl Stolting, Stolting Electric Co., Santa Rosa, Calif.; W. R. Grasle, Sr., W. R. Grasle Co., Portland, Ore.; J. D. Hilburn, Boese-Hilburn Electric Service Co., Inc., Kansas City, Mo.; Sam Riezman, Sachs Electric Corp., St. Louis, Mo.

NECA Contractors At Washington Convention

60th annual meeting and seventh electrical trade exposition of the National Electrical Contractors Association was held in Washington, D. C., October 10-14. For the convention report see page 178.

William Wescott, Puerto Rico Electric Construction Co., San Juan, P. R.; W. A. Hunt, Hunt Electric Co., Charleston, W. Va.; Herbert Johanson, Johanson Electrical Construction Co., Inc., New York, N. Y.; M. R. Minto, MacNutt Electric Co., New York N. Y.; Morris Newmark, Morris Newmark & Brother, Philadelphia, Pa.; Myron Freiberg, Electro Construction Corp., Los Angeles, Calif.; S. Shelly, Shelly Electric Co., Philadelphia, Pa.; F. C. Hoffman, Bogalusa Air Conditioning & Electric Co., Inc., Bogalusa, La.; A. W. Loew, Loew Electric Co., Ft. Wayne, Ind.

J. M. Nairn, Superior Electric Co., Jersey City, N. J.; E. J. White, II, Edward J. White Co., Newark, N. J.; R. M. Kehne, Kehne Electric Co. Inc., St. Paul, Minn.; H. S. Kostka, Kostka Electric Co., St. Paul, Minn.; J. D. O'Connor, Luppen & Hawley, Sacramento, Calif.; G. C. White, Empire Electric Co., Ft. Worth, Tex.; W. N. Collins, Collins Electrical Construction Co., St. Paul, Minn.; D. C. Smith, Dewey Electric Co., Ventura, Iowa; N. E. Smith, Chace Electric Co., Fall River, Mass.; W. J. Acker, Acker Electric Co., Manhattan, Kan.

A. B. Weinfeld, Power & Equipment Co., Columbus, Ohio; Albert Frank, Eastern Electric Co., Boston, Mass.; J. W. Frommer, L. K. Comstock & Co., Inc., New York, N. Y.; Joseph Oehrig, Lindsay-Wright, New York, N. Y.; E. L. Heine, Albin Gustafson Co., New York, N. Y.; Harry Walling, Walling Electric, Freeport, N. Y.; E. J. Foley, Syosset, N. Y.; Gordon Seaman, Geeco Electric, Farmingdale, N. Y.; Charles Michaels, Charles Michaels, Inc., New York, N. Y.; Francis Robinson, Robinson Electric Co., Flint, Mich.

R. E. Hammond, Hammond Electric Co., Inc., Mt. Kisco, N. Y.; W. E. Chappell, Colter & Chappell Electric Co., Winston-Salem, N. C.; Loren Turner, Turner Electric Service, Ann Arbor, Mich.; W. H. Brown, Brown Electric Service, Jackson, Mich.; D. B. Haring, Hatzel & Buehler, Inc., New York, N. Y.; Rufus Wilson, Wilson Electric Co., Independence, Mo.; W. J. Tynan, Edward Joy Co., Syracuse, N. Y.; W. J. Rowley, Hillebrand & Owen, Inc., Syracuse, N. Y.; W. A. Collins, Collins Electric Co., Springfield, Mass.; D. J. Barron, R. A. Turner Co., Springfield, Mass.

G. T. Curran, Red Top Electric Co., Emeryville, Calif.; W. J. Spaulding, Red Top Electric Co., Hayward, Calif.; C. W. Whitmore, Whitmore Electric Co., Miami, Fla.; Fred Hatcher, Hatcher Electric, Miami, Fla.; J. E. Helbling, L & H Electric Co., Mandan, N. D.; J. M. Schroeder, Midwestern Electric Construction, Grand Forks, N. D.; L. P. Harvey, Schoolfield-Harvey Electric Co., Charleston, W. Va.; Morris Dorn, Dorn Electric Co., Maumee, Ohio.

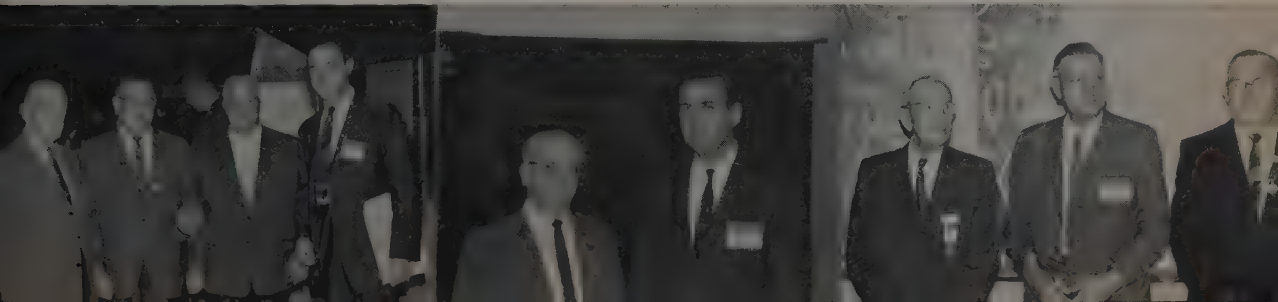
E. G. Molz, Hickson Electric Corp., Rochester, N. Y.; R. A. Goeller, Jr., Hatzel & Buehler, Inc., New York, N. Y.; Melvin Oien, Thompson Electric Co., Cloquet, Minn.; W. S. Johnson, Arrowhead Electric, Inc., Duluth, Minn.; Roy W. Springer, Boss Electric Co., Superior, Wis.; Erle Mitchell, Commercial Electric Co., Duluth, Minn.; Alfred Drew, J. J. Reddington Electric Service, Boston, Mass.;J. J. Reddington, J. J. Reddington Electric Service, Boston, Mass.

Irwin and Abram Haupt, Haupt Brothers, Philadelphia, Pa.; C. I. Berrell, Howard P. Foley Co., Inc., Salt Lake City, Utah; J. W. Slaughter, S & S Construction Co., Inc., Olathe, Kan.; W. L. Dyer, Empire Electric Co., Ft. Worth, Texas; W. J. O'Brien, W. J. O'Brien Electric Co., Inc., Chicago, Ill.; Albert Newgard, Henry Newgard & Co., Chicago, Ill.; Charles Fremder, Fremder Electric Co., St. Louis, Mo.; R. J. Roemerman, Roemerman Electric Co., St. Louis, Mo.

M. D. Hoffman, Eastern States Electrical Contrs., Inc., New York, N. Y.; Milton Hart, Meyerbank Electric Co., Inc., New York, N. Y.; A. R. Manville, J. Livingston & Co., New York, N. Y.; Joseph Foreman, Rochester, N. Y.; Richard Gordon, NECA, Rochester, N. Y.; W. N. Parkes, T. H. Green Electric Co., Inc., Rochester, N. Y.; Richard Haag, Haag Electric Co., Geneva, N. Y.; P. J. Panzeca, Pansco Electrical Construction Co., Elmont, N. Y.; Al Bender, Bana Electric Co., Farmingdale, N. Y.; M. E. Glennon, Meeker Electric Co., Lake Ronkonkoma, N. Y.

G. W. Graves, Graves Electric Co., Wilmington, N. C.; R. K. Robinson, Robinson Electric Co., Charlotte, N. C.; Hilliard Travis, Travis Electric Co., Nashville, Tenn.; Oakley Christian, John Bouchard & Sons Co., Nashville, Tenn.; S. E. Husselman, Merrell Electric Co., Cleveland, Ohio; T. A. Haines, London Road Electric, Cleveland, Ohio; Rudy Baacke, Standard Electric Co., Jacksonville, Fla.; G. C. Carter, Jr., Standard Electric Co., Jacksonville, Fla.

P. J. Quinn, NECA, Newark, N. J.; W. G. Nordling, Nordling Dean & Co., Inc., Summit, N. J.; William Leibfried, William Leibfried, Inc., New York, N. Y.; A. D. Fischbach, Fischbach & Moore, Inc., New York, N. Y.; Philip Popik, Lightmore Co., Spring Valley, N. Y.; Roy Swenson, Mehl Electric Co., Pearl River, N. Y.; A. G. Ofenstein, Birmingham, Mich.; F. F. Tufts, John H. Busby Co., Detroit, Mich.; Fred Cunningham, Cunningham Electric Co., Anna, Ill.



UNDERGROUND INTERCONNECTIONS of street lighting systems herein discussed were generally via 600-volt PVC Nos. 8 and 6 copper wire in conduit. As shown, large-capacity wire reels were transported by low-bed trailer to pulling-in points, thereby facilitating direct feed and eliminating possibility for errors in measurement.

CIRCUIT WIRING was pulled from one mast pedestal to the next through conduit, trench-laid prior to surfacing of roadways. Pulling power was obtained by trucks equipped with tailboard basket-weave come-a-longs, while straight emergence of conductors from upsweeping conduit ells was insured by placing bull-wheel directly in line with conduit.

Parallel 240-Volt

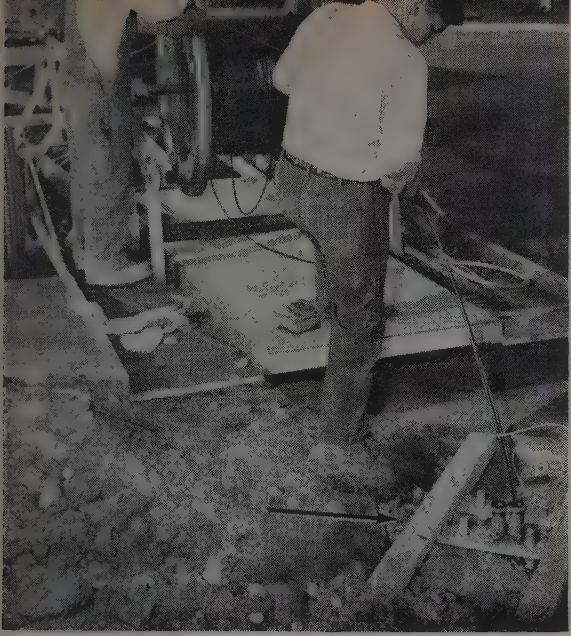
Improved M-V luminaires with built-in constant-wattage regulator ballasts connected in parallel on 240-volt underground circuits gave higher lighting levels at lower installation, operating and maintenance costs on over 50 recently completed projects. Trend prompted development of new 60-amp multiple relay switches with twist-lock receptacles for connection of activating photoelectric units.

STREET and highway lighting is a subject of growing importance, necessity, concern—and expense. For, as new freeways link cities, and roadways are constructed to serve new residential developments, shopping centers and industrial parks, the related problem of adequate illumination for thoroughfares adds an inescapable increment to the growing demand for public funds. For that reason, new equipment and theories resulting in *improved lighting at lower cost* merit attention from (a) customers, private as well as municipal, who must foot the bill; (b) utilities, committed to supply power for such installations; and (c) maintenance interests charged with the efficient operation of these installations. So, when an impressive number of street lighting installations indicate *average savings of over* $100 *per luminaire*, when compared with conventional practices, this fact deserves more than casual comment.

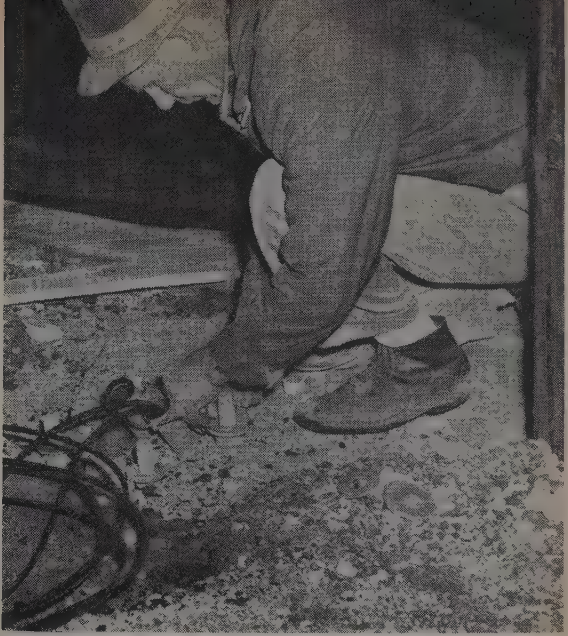
These savings were obtained in Santa Clara County, Calif., where over 50 separate street lighting installations involving over a thousand luminaires have been completed and analyzed for costs during the past year.

These street-lighting projects depart from conventional practice in several respects. For example, voltage is at 240 rather than at higher levels, which formerly ran up to 6000. Wiring of luminaires is in multiple, rather than in series circuitry. Switching is by means of multiple relay units, which can control as many as 40 luminaires on a single circuit and can be controlled by a single photoelectric activator. And, for aesthetics, wiring between luminaire standards is via underground conduit while lamps contained in lighting fixtures are color-improved mercury-vapor.

This approach to street lighting takes advantage of several new developments in the lighting industry. For example, the improved mercury-vapor luminaires contain built-in constant-wattage "regulator" ballasts, a feature which keeps power output within 2% of



ACCURATE ALIGNMENT of anchor bolts in concrete pedestals was insured by using simple wooden H-frame (see arrow), with holes drilled through wooden members in desired configuration. After form was positioned and leveled, nuts were spun over bolt tops and bolts were inserted through hole in form.



SMALL BUBBLE LEVEL was used to insure exact horizontal alignment of nuts and washers for support of mast. Note existence of protective grounding cable and bushing. System safety was also furthered by reduced voltage level, 240 as contrasted to 6000.

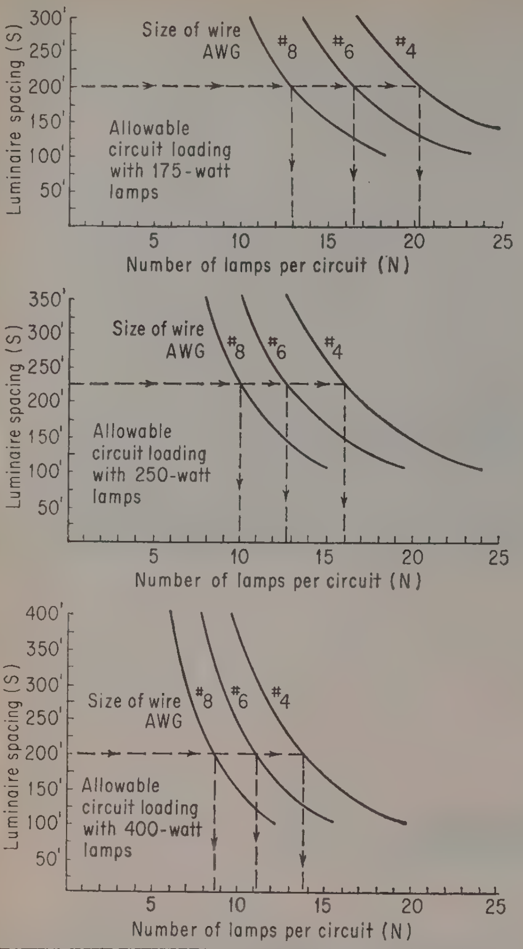
Street Lighting

rated design values even when input voltage fluctuates by as much as 13%. Moreover, with these regulator ballasts, tap selection is not required; inrush current is slightly less than normal line current; primary current can dip as much as 50% without extinguishing the arc; power factor remains constantly above 90%, while related wattage loss for ballasting is below 12%.

In the absence of large voltage fluctuations, and with larger switches now available, more lamps can be wired in multiple than was formerly possible. And, at the same time, size of conductors may be decreased. Wire sizes for installations here analyzed generally are Nos. 8 and 6. No. 4 conductors are used only in rare instances. With cable sizes decreased, and with insulation ratings correspondingly dropped from 8-kv to 600-volt classification, cable costs can be cut by as much as 40%, while

MAST COMPONENTS were trucked to jobsites in bulk, spray-painted at a central location, then shifted to various pedestal positions by pole trailer for final assembly into complete pre-wired standards.

MERCURY-VAPOR LUMINAIRES were partially prewired partially assembled in the field. Ballasts, reflectors and lamps being positioned and connected prior to attachment to luminaires.



ALLOWABLE LOADING OF UNDERGROUND STREET LIGHTING CIRCUITS WITH MULTIPLE MERCURY-VAPOR LUMINAIRES

Formula used to compute load:

$$N = \frac{-1 + \sqrt{1 + \dfrac{8 \times \text{KVA-FEET}}{P \times S}}}{2}$$

N = Number of lamps per circuit
S = Luminaire spacing in feet
P = Kva power load per lamp and ballast — 0.215 for 175-w lamp
0.31 for 250-w lamp
0.47 for 400-w lamp

Allowable KVA-FEET*
for #8 cable : 3900
for #6 cable : 6200
for #4 cable : 9600

Lumen output
for 175-w lamp : 6700
for 250-w lamp : 11000
for 400-w lamp : 20000

*Allowable KVA-FEET noted above pertains to underground installations in conduit, with Type PVC copper conductors, single-phase 90% PF, maximum voltage drop of 10% and rated circuit voltage of 240-v.

CHARTS indicate number of lamps that can be supplied in one direction from first luminaire of system without exceeding 10% voltage drop. It is assumed that adequate conductor capacity is provided in riser so that voltage obtained at first luminaire is not less than 230 volts. When service is delivered to central luminaire of installation, total number of lamps capable of being served would be twice the value indicated by the charts, plus one more to include the central fixture. For example, with 400-watt luminaires spaced 200 ft apart and with the system served from the center unit, a No. 8 circuit would handle 17 fixtures (8x2 plus 1); a No. 6 circuit could accommodate 23 lamps, while a No. 4 circuit could serve 27 luminaires. To obtain kva-ft of a system, the power load of each lamp and ballast is multiplied by its distance from the transformer, these several values then being added. For example, a luminaire 200 ft distant from a transformer, containing a 400-watt lamp (0.47-kva load, including ballast), would be 94 kva-ft (0.47 x 200).

additional related savings may be realized by using smaller-sized conduit. Pulling-in and connecting smaller-sized wire is also easier and faster, resulting in over-all installation savings in time and dollars. These savings likewise pertain to the making of parallel 600-volt connections rather than higher-voltage series splices.

Another major cost reduction is related to the elimination of pole-mounted constant-current transformers required for series circuiting. For example, a typical 30-kw C-C transformer with associated oil switch, photocell relay, switching equipment and riser extension to the initial luminaire on the circuit approximates a cost of $3000. Therefore, the elimination of this equipment constitutes an important saving for the supplier of power for street-lighting purposes. This investment for constant-current transformers might not be considered critical in areas of established static population, where relatively few new street-lighting installations are being considered. However, in sections of the country where population is mushrooming and enormous demands are being placed upon all types of utility service, this cost factor can become an important item. To illustrate, during 1959, constant-current transformers related to new street-lighting installations located in sections of California served by the Pacific G&E Company represented an investment exceeding $¼-million. Since C-C transformers are not required to serve 240-volt multiple circuitry being here discussed, potential savings to the utility are represented as being considerable.

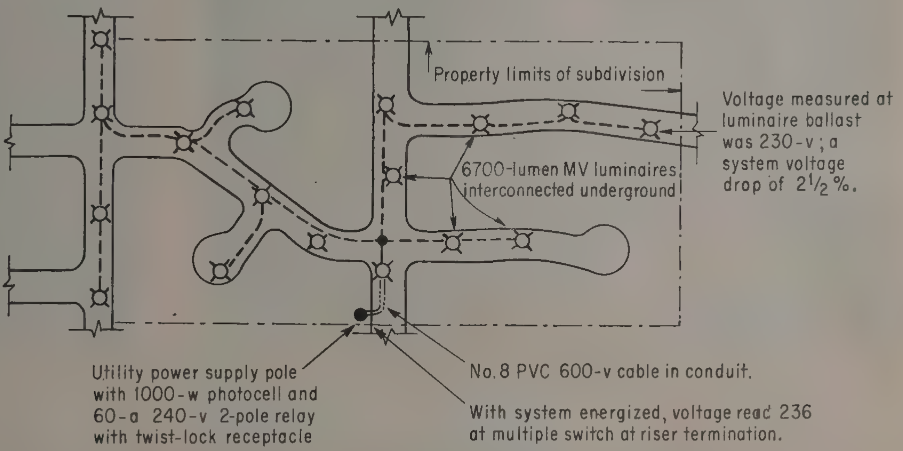
In the case of a typical 30-kw constant-current transformer being used in connection with series-wired 400-watt mercury-vapor lamps equipped with high-power-factor ballasts, a maximum of 36 luminaires could be served, indicating a power-supply outlay of about $83 per lamp in the installation. However, if the same number of new 400-watt M-V lamps and ballasts were connected in multiple on a 240-volt underground service such as we are now considering, thereby permitting the use of standard distribution-type transformers and control equipment, the cost per lamp would check out around $36, a cost reduction of over 50%.

It should be noted that this illustration considers a system involving 36 luminaires, whereas in practice a large proportion of installations involve 20 luminaires or less. With fewer luminaires being considered, per-unit costs go up faster for series systems than for multiple installations. And, if a circuit involves only 14 400-watt M-V lamps, as is the case in many instances, the series-multiple power-supply cost-per-luminaire comparison would be in the order of $151 to $49. These two comparisons indicate that power-supply savings can vary from less than $40 to over $130 per luminaire, the average for the various installations involved in this study being around $111.

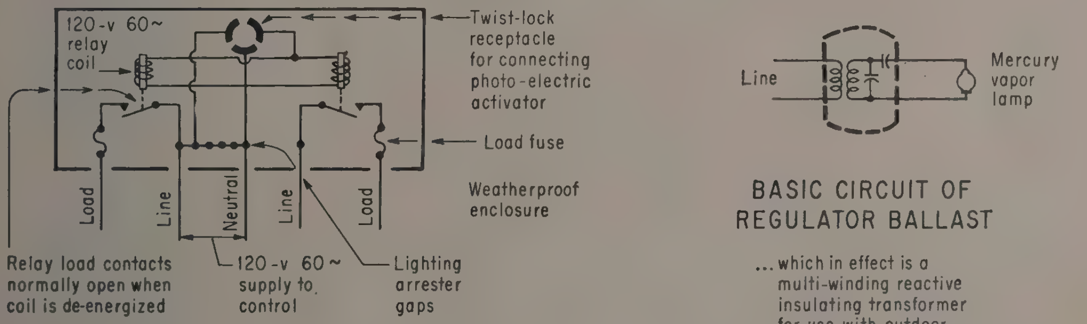
Another development contributing to this economical lighting combination was the creation of new 60-amp 240-volt single-phase multiple-relay switches equipped with dual-element fuses and twist-lock receptacles for plug connection of independently mounted photocell activating devices. (And there are prospects that similar type switches rated for 100 amps may soon be available as well.)

Until recently, such relay devices could be obtained only for 240-volt service in capacities up to 15 amps, that is, capable of switching only six 400-watt mercury-vapor lamps. Now, however, new 240-volt relay assemblies can control 400-watt lamps in groups up to 22 in number, with an allowance of 2½ amps of switching capacity for each lamp on the circuit to insure reliable starting.

This quantity of lamps capable of being placed on a single 240-volt circuit is surprisingly large. Yet, as verified by design curves presented with this discussion, a No. 6 circuit serving 400-watt M-V lamps spaced on 125-ft centers can contain as many as 14 luminaires *in each direction* from a central control switch. Or, with 175-watt M-V lamps spaced 200 ft apart, a No. 8 circuit could accommodate up to 13 luminaires in each direction,


Property limits of subdivision
Voltage measured at luminaire ballast was 230-v; a system voltage drop of 2½%.
6700-lumen MV luminaires interconnected underground
Utility power supply pole with 1000-w photocell and 60-a 240-v 2-pole relay with twist-lock receptacle
No. 8 PVC 600-v cable in conduit.
With system energized, voltage read 236 at multiple switch at riser termination.

BASIC LAYOUT OF SUBDIVISION STREETS AND LUMINAIRES


120-v 60~ relay coil
Twist-lock receptacle for connecting photo-electric activator
Load fuse
Weatherproof enclosure
Load
Line
Neutral
Line
Load
Relay load contacts normally open when coil is de-energized
120-v 60~ supply to control
Lighting arrester gaps
Line
Mercury vapor lamp

CONNECTION OF 240-V CONTROL RELAY

BASIC CIRCUIT OF REGULATOR BALLAST

...which in effect is a multi-winding reactive insulating transformer for use with outdoor mercury-vapor lighting system.

STREET LIGHTING for small residential subdivision has 17 175-watt mercury-vapor luminaires served by power distribution system that also serves electrical loads in 61 Medallion homes. Cost of conventional series service (including 10-kva 6.6-amp 12-kv constant-current regulator, oil switch, photoelectric relay, cutouts, ground, protective devices and 8-kv cable) would have approximated $1950. By comparison, cost of multiple 240-volt service (including 60-amp multiple switch, larger photoelectric relay, 5-kva additional transformer capacity and 600-volt cable) actually was only $202; representing an appreciable initial service-supply saving. In addition, power losses (including ballasts, RO, transformers, etc.) would have been 1170 watts for series installation as compared with 800 watts for multiple system. By installing mercury parallel-connected luminaires rather than higher-wattage lower-lumen incandescent lamps in series, light output was increased 75% while over-all savings to power supplier were reduced 85%.

LUMINAIRES ARE ATTACHED to hollow mast arm. Photo shows wiring components. After securing cover and asymmetrical lensed dome . . .

ASSEMBLED MAST is positioned above pedestal by means of motorized truck-mounted crane. Operator swings pole into position and slowly lowers it while . . .

BASE COLLAR of mast is guided over pre-positioned, leveled anchor bolts in poured concrete pedestal. Pole is then secured permanently by means of . . .

HOLDING NUTS, spun down and snugged tight by ratchet wrench. Accurate alignment of mast is insured because supporting nuts were leveled earlier. Finally . . .

ORNAMENTAL CAPS are placed over anchor bolts and luminaire leads are parallel-connected to feeders.

plus an extra luminaire mounted on the central standard.

These design curves were prepared with a maximum allowable voltage drop of 10%. And, having checked many actual operating data against these curves, the assumptions prove to be well within practical limits.

It should also be noted that one circuit requires only one switch controlled by one photocell unit. This eliminates the necessity to install and maintain an individual photocell device on each luminaire.

240-Volt Multiple-Relay Switch

As specified and designed for installations considered in this treatise, 240-volt switching assemblies are 2-pole multiple-relay units equipped with dual-element load fuses and 3-point expulsion gap lightning arrestors, thereby protecting coils from either internal line or external lightning power surges. Load contacts are normally open, coils being de-energized by 120-volt line-to-neutral power. Spring-reinforced silver-plated fuse clips insure positive fuse contact and improve service life by minimizing progressive arc damage to fuse assemblies.

These switching units are contained in weatherproof gasketed enclosures. Special brackets permit mounting to power pole cross-arms, and special twist-lock plugs permit interconnection of photoelectric activating relays.

As a final consideration it is pertinent to add that selection of 240-volt service was dictated by several considerations, such as its ready availability, the corresponding elimination of high-voltage hazards related to 6000-volt installation and maintenance, and the economical consideration of less-costly lower-voltage system components.

Careful cost analysis of numerous actual installations located along main thoroughfares indicates that single-switch, 240-volt, parallel-connected, mercury-vapor, underground-interconnected street-lighting systems offer considerable economic savings, when such systems are compared with either series-connected mercury-vapor or similarly wired incandescent installations.

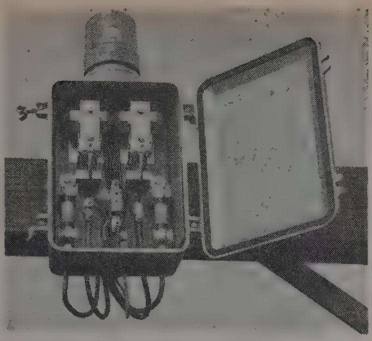
Another illustration pertains to a residential street-lighting installation in a California subdivision, where the initial plan called for 17 lighting units on 215-ft spacing, with 4000-lumen incandescent luminaires interconnected underground by series circuiting.

This plan subsequently was changed to use 175-watt integral-ballast-type mercury-vapor units placed on a 240-volt circuit controlled by a single switch. Number and spacing of luminaires remained the same. Yet, with M-V lamps delivering 8000 lumens instead of 4000 (as would have been the value with incandescent lamps), (1) the obtained light output was increased 100%; (2) the cost to the utility to establish the power supply was reduced 85%, due mainly to the eliminating of high-voltage constant-current transformers and associated service equipment; and (3) installation charges for luminaires, lamps, wire and conduit remained approximately the same for the two alternative plans.

In this instance the obtained lighting distribution, intensity and color of coated M-V lamps were most favorably noted, and local municipal engineering authorities have since adopted this new 240-volt system as *standard* for all new residential installations within that city's (Sunnyvale's) jurisdiction.

Cost comparisons also favor 240-volt multiple systems over series, overhead-interconnected, mercury-vapor lighting installations, and it is assumed that similar economical advantages would likewise relate to this multiple wiring approach when compared with overhead-interconnected series systems involving either incandescent luminaires, or incandescent and M-V units combined in the same system. Conclusions suggest that 240-volt underground-connected multiple-circuited M-V street lighting systems offer possibilities for increasing lumen output from luminaires at reduced installation and operating costs, and with reduced hazard. These several factors constitute desirable plus-values for municipal and private purchasers of equipment, maintenance personnel and utility suppliers of power.

As indicated by accompanying illustrations, job efficiency may be promoted through use of modern equipment, practical mass-production and time-saving routines. For example, since all jobs herein discussed pertained to new paving projects, it was possible to trench-lay conduit between luminaire mast positions prior to street surfacing operations, with such underground conduit runs sweeping up at center-pedestal points via large-radius ells. Ells were then capped to exclude dirt and moisture and were equipped with grounding bushings and bare stranded grounding cable connected in turn to driven rods at each pole location.



MULTIPLE RELAYS controlling mercury-vapor luminaires on multiple 240-volt circuits are equipped with dual-element load fuses and arresters enclosed in weatherproof case. Brackets for pole crossarm mounting and twist-lock receptacles for connection of photo electric activating relays were designed specifically for street-lighting installation discussed in this article.

COMPLETED INSTALLATION of 400-watt luminaires at new Science Center (at Mountain View, Calif.) indicates clean uncluttered appearance of project and complete absence of overhead wiring. Here over 1½ miles of roadway are lighted by 44 luminaires parallel-connected on three 240-volt underground circuits.

Anchor bolts for luminaire masts were then positioned over excavated pier cavities. This procedure was simplified through use of wooden H-frames having holes drilled in the wooden members to duplicate the configuration of bolt holes in mast base collars. With forms accurately positioned and leveled above upsweeping conduit stubs, nuts were temporarily spun down over bolt tops and bolts were inserted through holes of the form, thus hanging vertically in desired alignment pending the pouring of concrete. After concrete footings had solidified, nuts were removed from bolt tops and undamaged forms were removed for re-use.

Job efficiency was likewise obtained by using considerable mobile equipment during subsequent feeder cable installation operations. For example, cable was received on large-capacity reels, which were transported directly to feed-in positions on low-bed truck-drawn trailers. To insure straight emergence of cables from ends of conduit at successive pull-out pedestal points, a second truck was positioned so that a bull-wheel secured to the tailboard was located in direct line with the throat of the related upsweeping ell. Power for pulling was obtained by securing cables to the tailboard of a third truck by means of basket-weave come-a-longs.

Mobile equipment was also used to transport luminaire masts and components to central sites for spray painting and to shift components to pedestal points for assembly and erection. This latter routine was facilitated by use of a motorized hydraulic boom rig.

Prior to erection of masts on their pre-poured concrete piers, datum nuts and washers were spun down over anchor bolts and leveled accurately to insure firm support for mast bases. Then, after masts had been crane-lowered over these base-supporting datum nuts, additional washers and holding nuts were snugged down and tightened with aid of ratchet wrenches. Holding bolts were finally concealed by placement of ornamental cover caps, and branch circuits from luminaires were parallel-spliced to underground conduit-contained feeders.

Technical design details pertaining to these installations were developed by Pacific G&E engineers Rex Gardiner, Eugene Monahan, John Moran and Kory Scholberg, who jointly investigated application possibilities for this new approach to street lighting, and who suggested several practical modifications in the construction of multiple-relay switches. Comments concerning installation methods were contributed by Chester Jessen and Gene Putnam, manager and foreman respectively for Progress Electric of Palo Alto, the contracting organization responsible for many of the projects reviewed in this discussion.

HORWOOD JONES, co-owner of the Alex F. Jones Electric Corp. stands at main power CB assembly, which is contained in an indoor metalclad switchgear cubicle at the Morris Machine Works plant. Breaker constitutes the primary disconnecting means.

LOAD-CENTER unit substation typifies two such package assemblies installed in the shop area of the new plant. Each substation features an askarel-filled primary interrupter switch, a 3-phase, 4800 to 480/277-volt askarel-filled transformer, and two to three 600-amp, 480-volt secondary feeder breakers. Wire fence enclosures around both unit substations and the metalclad primary switchgear provide adequate protection from overhead cranes and swing hoists.

Electrical Highlights of a Modern Machine Shop

Completely flexible power distribution and high-intensity lighting head a host of design and installation techniques in a new machine shop.

By J. H. Watt

EFFECTIVE design and installation techniques in a modern industrial electrical system depend on a thorough knowledge of the plant process. Such a careful analysis produced a highly flexible power and lighting distribution at the new 20,000-sq-ft machine shop for the Morris Machine Works, Baldwinsville, N. Y.

Since the primary function of this plant is designing and manufacturing large custom-made centrifugal pumps, electrical system flexibility was necessary to permit speedy interchange of machine tools required to meet changing production schedules. Moreover, the electrical installation included additional service and feeder capacity to handle future anticipated increases of load.

The Alex F. Jones Electric Corp., Syracuse, N. Y., designed and installed the electrical system, which features: a primary service and feeder to two load-center unit substations; four 600-amp feeder busways, which feed 21 100-amp. overhead subfeed busways; high-intensity Power-Groove lighting at 480Y/277 volts; 24-volt relay switching for 277-volt lighting; bus-drop cable to machines; and plastic-covered trolley conductors for overhead cranes.

Primary Service and Feeder

Primary service to the plant is 4800 volts, 3-phase, where six 250 MCM 5-kv cables (two per phase) extend underground in a 4-in. rigid-steel conduit from the utility pole to an indoor metalclad switchgear, which contains the main power breaker and associated equipment, including an ammeter for each phase.

Operating on the air magnetic blow-out coil principle, the power breaker has an interrupting capacity of 100 mva. Extremely inverse time-overcurrent relays control the overload contacts of the breaker.

SECONDARY CONDUITS provide main feeder extension from 4-pole, 480-277-volt busway cable-tap boxes to top of the secondary section of 750-kva unit substation. Each riser consists of two 3½-in. conduits, containing four 500 MCM conductors (run in multiple) to provide 600-amp capacity. Note back-to-back tap boxes, which supply 600-amp busways running in opposite directions.

TYPICAL BUSWAY RUNS are shown in photo. Smaller 100-amp, 4-pole busways tap into main 600-amp feeder busways at right angles, and are fuse protected at point of tap. Notice that all supports for busways, hangers and fixtures are clamp-on types, which eliminated drilling and tapping, thus speeding up installation.

Relay tap-range settings vary from 4 to 16 amps, and the present setting is 5 amps (which represents 200 amps flowing in the primary). Current-transformer ratio is 200:5. The breaker is solenoid-closed at 125 volts dc, which is supplied by batteries located on racks adjacent to the metalclad switchgear. To protect the switchgear and batteries from moving vehicles and unauthorized personnel, a wire-mesh fence surrounds this equipment.

From the load side of the main power breaker, a single 4800-volt feeder, consisting of two 250 MCM, 5-kv cables per phase in a concrete-encased 4-in. non-metallic conduit, runs underground to feed two unit substations, located at the two largest concentrations of load. Each unit substation contains a 3-phase askarel-filled transformer, rated at 750 kva, and a primary askarel-filled interrupter switch. Both switches are key-interlocked with the main power breaker to prevent closing them against load or faults. Secondary voltage at each substation is 480Y/277 with overcurrent protection consisting of two 3-pole circuit breakers rated and set at 600 amps. At one unit substation, an additional 400-amp circuit breaker feeds the existing load center in an adjacent building.

Secondary Distribution

From the top of each secondary cubicle, conduits carry 600-amp feeders to cable-tap boxes located overhead. Here the feeders connect to 4-pole, aluminum-busbar, non-ventilated feeder busways, which provide the 480Y/277-volt supply for the entire plant. Four-pole 100-amp busways are then tapped off the 600-amp main busway at right angles. Where busway is reduced in size, overcurrent protection is provided at the point of tap.

By the judicious use of beam clamps, slip-in rod-hanger supports and slotted angle steel, installation time for busways and other overhead equipment was held to a minimum. At the same time, these methods of support make it possible to reroute any of the equipment at minimum cost should it become necessary in the future. Horwood Jones, co-owner of Jones Electric, stated that while the clamp fittings used cost more than conventional fittings, the labor saved in drilling and threading more than made up the difference.

Because of multiple runs and clearance from craneways, all overhead 100-amp busways were installed flatwise on supports spaced every 5 ft.

Bus-drop cables supply 480-volt machine tools from the overhead busways, and each cable contains a grounding conductor to ground equipment. At each end of the cable drop, strain-relief fittings protect the cable from damage. In addition, other similar fittings are used to take up slack in the cables.

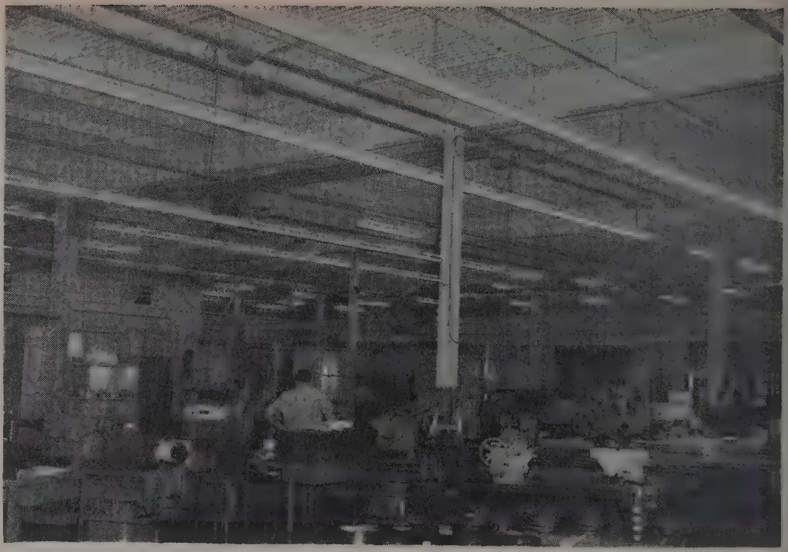
As an added safety factor, and for convenience in maintenance, each cable drop terminates in a single fused safety switch at the machine. Fuses are selected and coordinated so that those closest to the machine will open in the event an overload occurs at this point.

While most of the load in the machine shop area operates from the 480Y/277-volt supply, two 15-kva, 3-phase dry-type transformers provide 208Y/120 volts for smaller equipment. In each case, a ¾-in. conduit with three No. 10 conductors runs from a fused busway disconnect to a wall-mounted transformer. From the secondary, a short length of 1¼-in. conduit with four No. 6 conductors extends to the 208Y/120-volt circuit-breaker panelboard below. Actually, these are the only two panelboards in the shop area of the plant. The rest of the branch-feeder and branch-circuit overcurrent devices are installed at take-off points on overhead busways. One additional 3-phase dry-type transformer, rated at 45 kva, handles 120-volt equipment, receptacle circuits and some lighting in the office section. Cellular metal floor raceways, installed in the office area provide complete flexibility for floor receptacles, telephone and intercom outlets.

Lighting

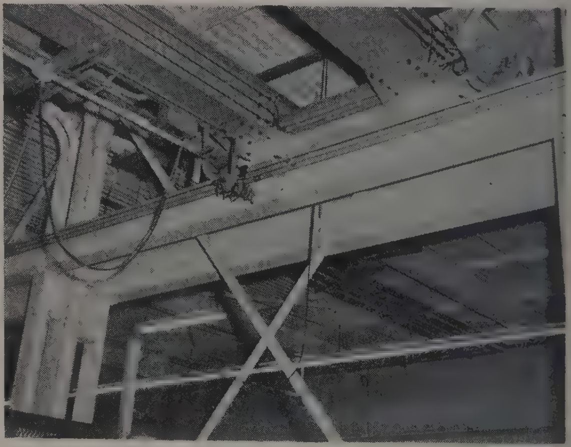
Fluorescent luminaires, with 277-volt ballasts, constitute the

WALL-MOUNTED, 480 to 208Y/120-volt, 3-phase, dry-type transformers, rated at 15 kva, are typical of two such units installed in 20,000-sq-ft machine shop area. Carl Pennock, foreman for Jones Electric Corp., is shown making final connections in 208-volt panelboard. Two such panels supply 120-volt receptacles and small tools. The remainder of machine shop equipment operates on 480-volt circuits.



CROSS-SECTION VIEW of the shop area of Morris Machine Works shows overhead busway system with cable drops to machines, and continuous-row, 2-lamp luminaires with 1500-ma Power-Groove lamps. Lighting intensities at work levels are 90-fc, maintained. Notice that desk-type lamps were not required at machines as the result of higher lighting levels.

COLORCEIL LIGHTING SYSTEM in drafting room contains single-tube Power-Groove lamps in plastic-diffused surface channels. Maintained lighting intensity at drafting boards is 180-fc.



SAFETY-TYPE, plastic-coated, trolley contact conductors feature maximum protection from exposure to live 480-volt supply. Angle supports for trolley assemblies are welded to structural beams. All overhead cranes in machine shop use this enclosed-conductor method. In the lower part of photo, a clamp fitting and spring cable grip hold bus-drop cable in position.

overhead lighting in the shop and most of the office areas.

Luminaires in the shop area are the 2-lamp industrial type and total 235. Lamps are T-17, 96-in., cool-white Power-Groove types, operating at 1500 ma and producing a maintained value of 90-fc at working levels below. The effectiveness of this high-intensity lighting is shown in accompanying photos by the absence of small lights, usually attached to machines where overhead lighting is of lesser intensities.

Fixtures are generally installed in continuous rows, and are rod-suspended from I-beam clamps and slotted angle supports. Branch circuits for the luminaires are 20 amps, 4-wire, 480Y/277 volts. All overcurrent devices are contained in the tap boxes, which plug into the 4-pole, 100-amp busways. In this way, lighting panelboards and long conduit homeruns were eliminated. Moreover, lighting units can be added or relocated at a minimum of expense, which further verifies the advantages of a completely flexible electrical system.

Low-voltage relay switching at 24 volts controls all 277-volt lighting units in the plant, and proved to be less expensive than conventional line-voltage switching. One low-voltage switch controls three rows of luminaires in the shop area.

Lighting highlights in the office area are featured in the engineering drafting room, lobby, executive offices and conference room where the ceiling-suspended system is Colorceil. Except in the lobby, plastic-diffused Colorceil channels contain single-tube 1500-ma Power-Groove fluorescent lamps, which produce high lighting intensities at desk levels. In the drafting room, 180-fc are maintained. By selective switching, levels can be varied from 50- to 250-fc in the executive office, and from 50- to 150-fc in the conference room. The lighting in the lobby contains T-12, 425-ma cool-white lamps.

Other office areas contain either recessed fluorescent troffers or incandescent luminaires. The incandescent units and a few fluorescent troffers are the only luminaires in the plant that operate on 120-volt circuits.

Overhead Bridge Cranes

To expedite moving products from one machine to another, three overhead bridge cranes (ranging in size from 5 to 10 tons) have been installed. A fourth overhead crane is located in the receiving area, and an additional 10-ton crane for use outside the plant is under construction.

All cranes operate on 480 volts, 3-phase. To provide maximum protection, main contact conductors incorporate U-shaped plastic insulation, which permit access to bare conductors only through the open-bottom slot. For maximum rigidity, electricians for Jones Electric welded all trolley-conductor angle-iron supports to structural members.

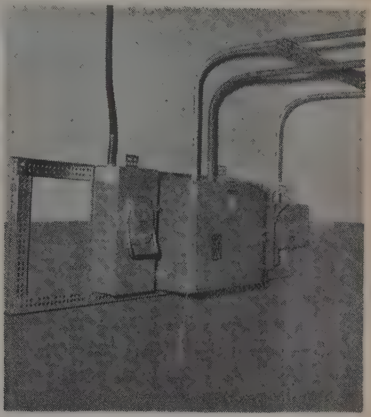
Pendant-drop pushbutton stations on the crane eliminate the need for crane operators and permit complete floor control for moving or positioning production items.

Spring cable grips protect the pendant-drop cords where they terminate at pushbutton stations and overhead crane-mounted control panel enclosures. Each pendant drop contains an individual grounding conductor to assure adequate grounding of the metallic enclosures for the pendant pushbutton stations.

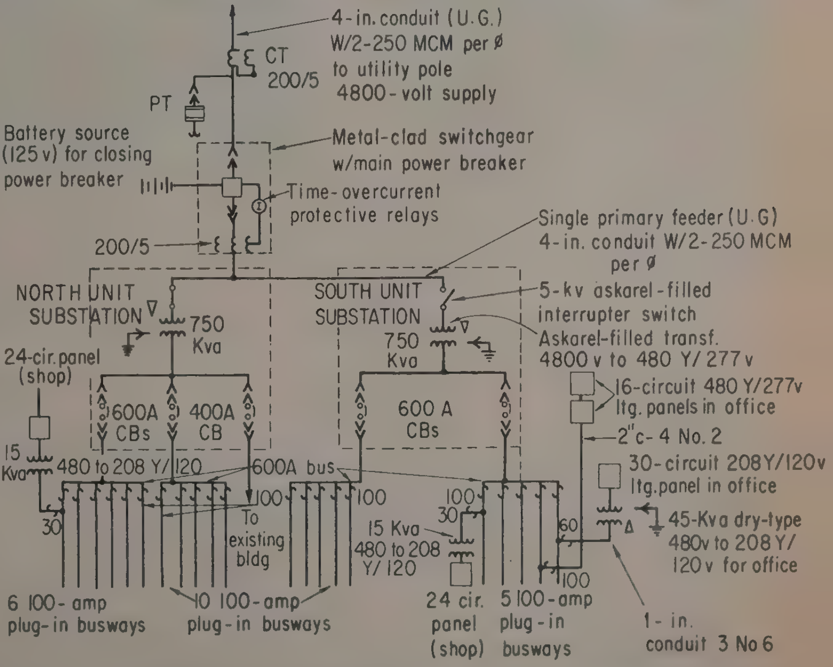
The hoist and craneway limit switches provide maximum protection against over-riding equipment by the machine operators.

In addition to designing and installing industrial electrical systems, Alex F. Jones Electric also offers complete maintenance contracts for industrial clients. Such contracts are usually sold at the completion of an initial installation.

EXECUTIVE OFFICE lighting system has lighting levels that vary from 50 to 250 footcandles through selective switching. Similar Colorceil, Power-Groove installation in the conference room produces from 50 to 150 footcandles, as desired. Ballasts are connected to 277-volt branch circuits.



PERFORATED ANGLE steel supports provide convenient method of mounting safety switches and control equipment. Angle supports are secured to concrete wall. Busdrop cable enters safety switch, dropping from overhead plug-in busway. Notice cable-grip connector, which supports 4-conductor cable-drop.



ONE-LINE DIAGRAM shows primary and secondary distribution system at the Morris Machine Works plant. Incoming service is 4800 volts, 3-phase and the majority of secondary distribution is 480Y/120 volts.

Safety in Electrical Systems

Minimize the hazards of electrical application in any plant by regular survey of all distribution and utilization facilities to eliminate faulty or unsafe conditions and to assure maximum safety in equipment installation and layout.

By Alfred L. Dowden, *Electrical Engineer, Liberty Mutual Insurance Co., Boston, Mass.*

SAFETY in the distribution and utilization of electrical energy in an industrial plant can be maintained at a high level by regular and thorough inspection of all electrical facilities. Such inspection is aimed at revealing any and all accident hazards throughout the plant. Unfortunately, a thorough safety survey of the electrical wiring, substation, switchgear, stationary and portable power-using equipment, lighting circuits, etc., in an industrial plant is seldom made as a separate and distinct undertaking. Rather, it is generally included as a part of the over-all inspection program of protective and preventive maintenance. This procedure tends to relegate any existing hazards to the background and results in the overlooking of many serious conditions that could be improved.

Manufacturing plants that utilize a large number of electrical devices—both portable and stationary—should, in the interest of employee safety, undergo a careful and comprehensive electrical survey at regular intervals. Once a year might be considered adequate for some plants. Others should inspect at more frequent intervals. In addition, in those industrial plants where there is an inadequate or unskilled maintenance force, very frequent special survey of possible or probable electrical hazards is extremely important. In fact, such frequent survey should be made mandatory.

Clear and effective instructions to employees of a plant can go a long way in boosting plant safety. All employees should be instructed that they must not, under any circumstances touch such electrical equipment as distribution switchboards and panelboards, high-voltage apparatus, fuse boxes or any of the lighting wiring and wiring leading to production machinery. Employees must also be taught never to attempt repair of electrical equipment. Repair tasks must be performed only by competent mechanics.

One of the most important factors in the whole concept of the safety survey is that the chief plant electrical man or an experienced electrical contractor supervise the inspection of electrical equipment. Only a competent, experienced electrical man will be able to detect actual and potential hazards and devise proper and effective safeguards. Competent supervision of the survey is very important in view of the fact that even low voltages—in the 50- to 110-volt range—can cause severe injury, burns, permanent disability and even death.

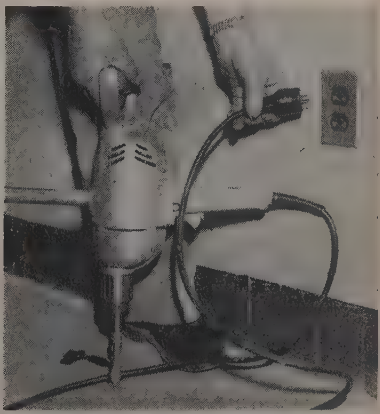
The following tabulation of Safety Requirements, Hazardous Conditions and Comments of Experience may very well be used in conjunction with general and specific inspection surveys of electrical systems and apparatus. Is your plant's electrical distribution system safe?

SAFETY REQUIREMENTS	HAZARDOUS CONDITIONS	COMMENTS OF EXPERIENCE
High-voltage substations should be completely enclosed.	Employees or members of the public may trespass in the area and contact the high-voltage conductors.	Structures of high-voltage substations seem to have the fascination of a "jungle gym" for small children. About a child a year is involved in a serious electrical accident—always a pitiful case. Enclosures of wire mesh screens of chain-link fences are commonly used for such installations. They should be approximately 7-ft high of 2-in. mesh with barbed wire strands on top. Sometimes access is gained under the fence. Therefore, it is best to have the bottom of the fence anchored in asphalt or concrete. Employees responsible for the installation and upkeep should watch for children playing around the area and be on the lookout for washouts under the fence that will give all the access needed for tiny and inquisitive children.

FENCE AND LOCKED GATE for outdoor substation prohibit access to unauthorized persons.

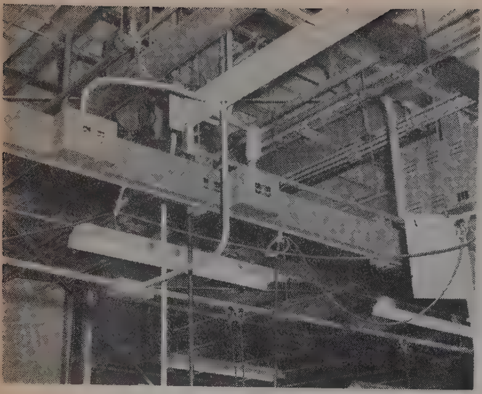
UNCOVERED PANEL presents a serious accident hazard to personnel because of exposed line terminals and possibility of arc propagation.

GUARD RAIL around unit substation on plant floor keeps employees away from accidental contact with operating handles of breakers.



UNGROUNDED CONNECTION of portable appliances with two-prong plug on cord presents the possibility of shock hazard due to ground fault of hot conductor to the metal frame of the tool. Simultaneous ground contact by person holding the tool impresses line voltage across the person.

SAFETY REQUIREMENTS	HAZARDOUS CONDITIONS	COMMENTS OF EXPERIENCE
The substation area should not be used for storage of stock, materials, tools or personal possessions.	Such storage may lead to uninformed persons entering the substation and being exposed to possible contact with live conductors.	Examples are the use of the substation enclosure for storing planking and material occasionally used for stagings. Employees using or handling this material would not be expected to know the hazards of the location. A common situation is the use of cubicles for the storage of lamps, fuses, or parts occasionally needed for replacement in the substation. In a recent case, a carpenter working on forms adjacent to the existing substation was electrocuted when he took a tool from his tool box. This kit had been stored for several days in a cubicle in which there was engerized equipment. Although a supervisor of the electrical department gave the carpenter access to the substation each day, he did not realize that the tools were being stored in the unlocked cubicle.



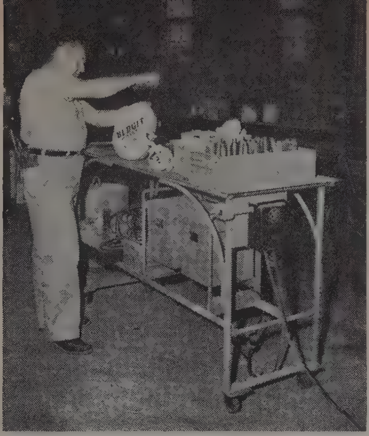
GROUND CONTINUITY of non-current-carrying metallic parts of electrical distribution equipment is assured by firm connections between various elements—trolley busway to conduit, to wireway, to plug-in busway and then back to grounding electrode at the unit sub.

GROUNDING CONDUCTOR connected to frame of dry-type transformer provides system ground for secondary neutral of 120/208-volt system fed by 480-volt delta primary. Conductor lug is bolted to common point of neutral and equipment enclosure to serve as common ground, providing maximum safety and effective operation of protective devices on secondary faults.

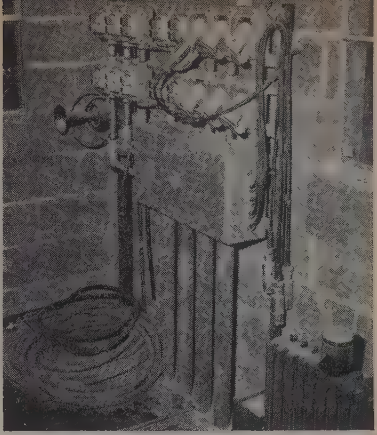
LIVE FRONT SWITCHBOARD is placed in a locked room accessible only to authorized electrical personnel, thereby eliminating hazard to employees.

SAFETY REQUIREMENTS	HAZARDOUS CONDITIONS	COMMENTS OF EXPERIENCE
The substation enclosures should be secure and locked.	An unlocked gate is an "open" invitation to a curious person to enter the hazardous area.	Keys to the gate's lock should be assigned to a responsible employee in charge. If it is a jointly owned sub-station, the utility should have a separate lock. In a recent inspection tour, the gate of a substation was found to be fastened with a length of heavy chain on which were two closed padlocks. The impression of a secured gate was quickly dispelled by a brief unraveling of the chain with both padlocks still closed on the chain links.
If the fence is of metal, and overhead wires or conductors cross it, the fence should be grounded.	One of the overhead conductors may break for any number of reasons, drop on the fence and charge it. A person touching the charged fence might be electrocuted or severely burned.	During the great New England hurricane of 1938, with its destruction of overhead power systems, the most serious public accident reported was due to a pedestrian striking a match on a metal fence, charged by a still unrepaired primary that had dropped on it. In another instance, a workman attempting to open the gate to an enclosure was electrocuted. An overhead primary was broken by wind and it fell on the fence several spans away from the gate. This grounding requirement is not universally accepted by electrical engineers, some of whom prefer to leave the fence ungrounded. Their preference appears to be outweighed by the greater safety in bonding the fence to the ground mat.
Nothing should be piled against the outside of the substation's protective fence.	Piles of lumber, barrels, or construction materials may give a person easy access over the fence and into the enclosure. Such people never seem to worry about getting out, once they are in. (The usual method of egress seems to be that they are carried out on a stretcher—dead.)	There seems to be a practice in congested industrial areas or yards to store material up against the enclosure. This is true, too, where the fence forms a part of the property line. The abutter may use the fence as a support for a storage pile, which reduces the height of the fence by the height of the pile.

EQUIPMENT GROUNDING for small cord-connected machines is provided by separate grounding conductor run with phase conductors in the rubber cord, with a ground terminal in the plug and receptacle. The ground terminal in the receptacle on the vertical conduit is supplied by a grounding conductor, which runs back to the bus, top switch from which circuit originates.



PORTABLE TEST BENCH has electrical test equipment supplied by rubber power cord which plugs into any convenient receptacle in the area. Grounding conductor run with power cord eliminates chance of metal stand becoming hot due to fault in the equipment attached to it.



HAZARDOUS LOCATIONS should be carefully equipped with equipment suitable for the purpose. Here a Class 2, Group G location—a grain elevator—uses dust-tight pushbuttons and receptacles.

SAFETY REQUIREMENTS	HAZARDOUS CONDITIONS	COMMENTS OF EXPERIENCE
Weather-resistant warning signs should be posted on the enclosure.	Uninformed persons must be warned of the dangers created by a hazardous location such as a substation.	Signs, such as "Danger High Voltage," should be posted on each side of the enclosure. If the enclosure is large, several signs may be needed on each side. These signs should be maintained on the outside of the fence. Mounting them on the inside reduces the visibility. Signs, due to aging, get damaged or become illegible. They should be replaced when this condition exists.
All wall entrances, windows, etc., opening on a substation adjacent to a building, should be effectively screened or barred.	Operations in the building may involve someone accidentally reaching out to contact the live conductor. Processes inside the building may involve the handling of conducting material such as rods or bars which can project through the opening to contact a live conductor in the substation.	In the confined quarters of some industrial plants the tendency is to install the substation against the building wall or in the corner of existing buildings. Existing openings are often unguarded, such as windows, which may be opened for ventilation. Another hazard of this arrangement is that a fire or fault inside the substation may be communicated inside the building. Since a substation is a permanent installation, it might be well to brick up the openings in the building wall.
The use of rigid conduit for enclosing the wiring in an industrial plant is preferable.	In addition to the protection of conductors from the effects of moisture, fumes and mechanical damage, the rigid conduit serves as a protective grounding conductor for the system.	Protective grounding is the basic preventive remedy against the effects of electric shock accidents in industrial plants. Although the mechanics of the conduit installation may result in metallic contact with ground throughout the system, the conduit should be bonded to be an effective grounding electrode as required by the National Electrical Code.
To be used as a protective ground, conduit should be continuous throughout the system.	If the conduit is broken or separated at any point, it will not serve as a protective ground.	A number of fatalities have occurred due to an apparent continuous conduit system that was broken at some point. In addition to checking for continuity with an ohmmeter at the time of installation, periodic checks should be made to guard against the possible loosening of fittings, revisions of the system, deterioration, or mechanical breakage that would destroy the continuity.

SAFETY REQUIREMENTS	HAZARDOUS CONDITIONS	COMMENTS OF EXPERIENCE
Where flexible metal conduit or cable is used in the wiring system, it is necessary to use a grounding conductor for each piece of equipment, in order to provide a satisfactory protective ground.	The sheath of flexible metal cable cannot be relied upon to provide a dependable grounding conductor.	Experience indicates that the sheath is difficult to connect to fittings in fuse boxes, switch boxes and panels in order to provide a dependable metallic contact. The use of a separate wire gives dependability with auxiliary grounding through the cable sheath, if it happens to be metallically continuous to ground.
Switch boxes, fuse boxes, distribution panels and the like should be kept closed and/or locked.	The open box, in many instances, provides an exposure to contact with live parts.	Locking of boxes is good practice. The preferred type of switch box is interlocked so it cannot be opened unless the power is off. Fuse boxes are also made with the fuses in a plug receptacle so that they cannot be replaced while the power is surging through the lines.
A fiber fuse puller should be used for removing or replacing cartridge type fuses.	Replacing cartridge fuses by hand exposes the employee to possible contact with adjacent live parts in the fuse box.	Incredible as it seems, there have been several serious accidents involving employees replacing cartridge fuses when using metal pliers. Hand contacts in this type of operation are relatively common. Another situation arises when attempting to replace fuses without disconnecting the load on the circuit. Still another situation results from failure to align the fuse in the clips so that one end of the fuse is energized and the other end touches the grounded case of the fuse box.
Where provided, interlocks should be maintained and not jumpered or tampered with.	Men working on interlocked equipment develop a reliance on the effectiveness of the interlock which, if it is jumpered or tampered with, produces a situation that they are not habitually familiar with. As a result, the man may be injured from working on equipment provided with interlocks which, in fact, have been made inoperative.	Interlocks are generally provided on electronic equipment, particularly those controlling high-voltage circuits. But, a number of power installations are also provided with interlocks, usually of the sequential key type. A properly designed interlock system in a power supply not only insures against errors but requires the man to follow a sequence of operations as governed by the keys in the system. It has been observed that, in those cases where interlocks have been cheated, the inspection or operation check being made could have been performed as well with the equipment de-energized. Just as much information would have been available with the equipment de-energized as energized. In spite of the provision for interlock systems, employees are well advised not to rely entirely on the interlocks but to operate the appropriate switches to actually de-energize the equipment. The interlocks are intended only as a supplementary means of de-energizing the equipment.
Metallic lighting sockets supplied by drop cord or rubber cord with key switches or pull chains are less desirable, from a hazard standpoint, than other types of lighting installations supplied with conduit.	Metal sockets are repeatedly involved in accidents where a man is handling them, possibly to turn the light on, and is simultaneously grounded by contact with some other ground in the immediate area.	A number of defects contribute to such accidents. One is the tightness of the dimensions of the socket parts which require good workmanship in connecting to the terminals. Another defect might be caused by a small strand of conductor in contact with the metal shell of the socket. In most wiring, where fabric or rubber cord is used, the metal is not grounded. Use of pull, chain sockets in areas such as washrooms or over sinks are unsafe because of the proximity of grounded metal and the ease with which a person can bridge the plumbing and a possibly charged pull chain. Lighting that is controlled by a wall switch, located in a safe area, is preferable.
The frames of motors and of machines on which motors are mounted should be provided with protective ground wires.	One of the most common types of industrial electrical accidents involves the charging of a motor frame or the frame of the machine on which a motor is mounted. It becomes easy for the employee to make contact with the charged metal and the adjacent ground.	On rigid-conduit systems, the conduit may serve as the ground connection. Because of vibration, the conduit is generally not connected to the motor. A short bonding strap should connect the conduit to the machine in order to afford a protective ground. In some installations, the grounding can be direct from the frame of the motor to an adjacent water pipe. If protective grounding is used, care must be taken to insure that all parts of the machine that might be charged are bonded and grounded.

SAFETY REQUIREMENTS	HAZARDOUS CONDITIONS	COMMENTS OF EXPERIENCE
Portable electrical tools should be subject to a periodic inspection to detect and repair evidences of misuse or abuse.	Because portable tools are not used in a fixed environment, many accidents occur where defective tools, that apparently operate, are used by employees who are simultaneously in contact with ground.	Periodic examination for mechanical and electrical defects will disclose conditions that may make the use of the tool hazardous in areas where the user is grounded. Many times, the defect does not interfere with the operation of the tool. Each tool should be identified and records kept so the periodic inspections can be carried on.
Every portable electrical tool should be provided with a protective ground.	The protective ground keeps any voltage from building up on the frame of the tool so that it will be impossible for a worker who is grounded to become a path between voltage and ground.	The best system of protective grounding on portable equipment is by means of a third wire in the cord (4 wires in 3-phase equipment cords) with appropriate plugs and outlets so that the protective ground connection is made automatically when the plug is inserted in the outlet. The protective grounding system should be periodically checked to be certain that it is complete. Its absence, due to a break, will not interfere with the operation of the tool. A protective ground may provide a false sense of security to any workman using an electrical tool.
In special situations such as work in furnaces or tanks where the man is in intimate contact with large grounded surfaces, a special system of power for lighting and tool operations is preferable. This system uses an isolating transformer which provides a local ungrounded system for the hazardous location.	In such special locations, it is almost impossible for the man to avoid contact with large areas of his body with grounded metal. Any defect in the lighting or the tool may be more serious due to the contact of the person with ground.	Special lighting systems for tank cleaning or furnace work use not only the isolating transformer but reduce the voltage to less than 50 volts. The possibility of a lethal shock is thus made more remote.
The lampholder of portable lights should be specially designed for portable lighting use.	The use of utility or brass-shell sockets on portable cords as a means of providing portable illumination has contributed to a number of fatal electrical accidents.	The design of a safe lampholder should provide a hand grip of non-conducting material, a socket that is well protected with insulating material to enclose the entire base of the lamp, and a metal guard to prevent lamp breakage. In some designs, the material of the lampholder is used to prevent accidental contact of the cage or guard with current-carrying parts. Other designs are such that the cage is included in the protective grounding circuit on the portable light.
In areas where explosive vapors or dust concentrations exist, a special type of lighting system should be used.	The conventional electrical wiring systems used in ordinary switches provides a source of ignition that may ignite explosive dusts or vapors.	The NEC specifies areas in which special consideration must be given to electrical wiring. Generally, these considerations involve the use of ground and gasketed plates on switches and boxes, sealed joints and ends of conduit to prevent the accumulation of dusts and vapors within the enclosure of the electrical conductors.
Electrical outlets located out-of-doors should be protected from weather hazards.	Moisture is a conductor of electricity and may create a short circuit within the outlet. Corrosion is accelerated by exposure to the weather so that good contacts may not be made.	The provision of outlets in the plant yard or on the outside of buildings is made necessary in a number of industrial plants. Special outlets for use in out-of-door exposures are available which provide a covering over the outlet when not in use.
A switchboard having exposed conductors on either the front or rear should be provided with barriers to prevent accidental contact.	The people who make those occasional contacts are usually not the switchboard operators. They are the janitors or workmen who use the area behind the switchboard as a storage place for tools and supplies.	If there is traffic in the area in front of the switchboard, a substantial railing may prevent people from walking too close to the board. The space behind the switchboard can usually be isolated by the erection of a gate between the switchboard and the wall at each end of the energized switchboard. It is preferable that access to the rear of the switchboard be from either end and that both gates be open if it is necessary for a qualified man to work behind the board.

• *ESTIMATING FORUM—XV*

Complete Contracts Versus Contracts With Extras

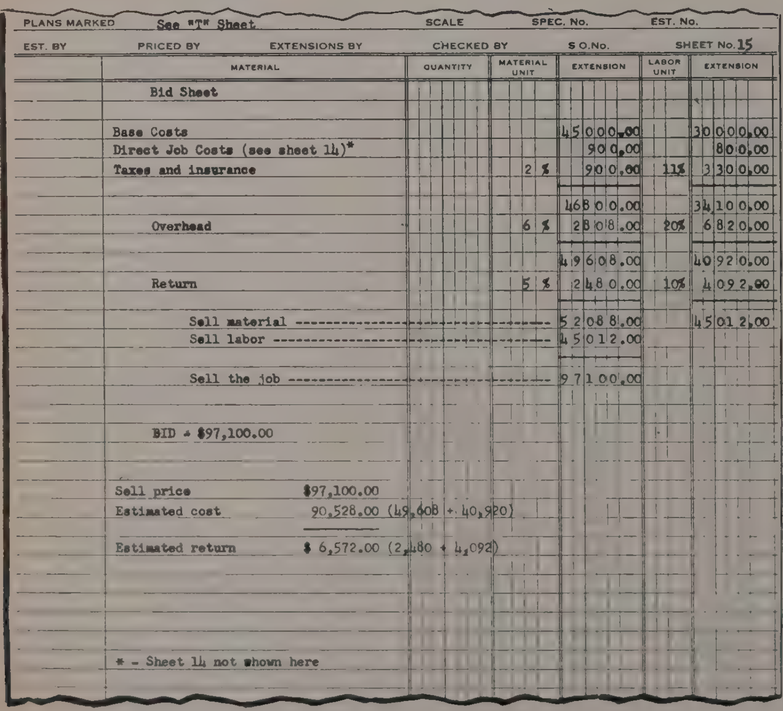
By **Ray Ashley**, *Research and Consulting Engineer, Oak Park, Ill.*

QUESTION:

Which is better, a contract that can be completed without changes and/or additions; or one that has many small orders (extras) in addition to the original contract?

ANSWER:

The contract that can be completed without changes or additions.



PLANS MARKED See "T" Sheet SCALE SPEC. No. EST. No.

EST. BY PRICED BY EXTENSIONS BY CHECKED BY S O.No. SHEET No. 15

MATERIAL	QUANTITY	MATERIAL UNIT	EXTENSION	LABOR UNIT	EXTENSION
Bid Sheet					
Base Costs			45000.00		30000.00
Direct Job Costs (see sheet 14)*			900.00		800.00
Taxes and insurance		2 %	900.00	11%	3300.00
			46800.00		34100.00
Overhead		6 %	2808.00	20%	6820.00
			49608.00		40920.00
Return		5 %	2480.00	10%	4092.00
Sell material			52088.00		45012.00
Sell labor			45012.00		
Sell the job			97100.00		
BID = $97,100.00					

Sell price $97,100.00

Estimated cost 90,528.00 (49,608 + 40,920)

Estimated return $ 6,572.00 (2,480 + 4,092)

* - Sheet 14 not shown here

FIG. 1—Original contract price was based on this bid summary sheet. Note estimated return on contract.

DISCUSSION:

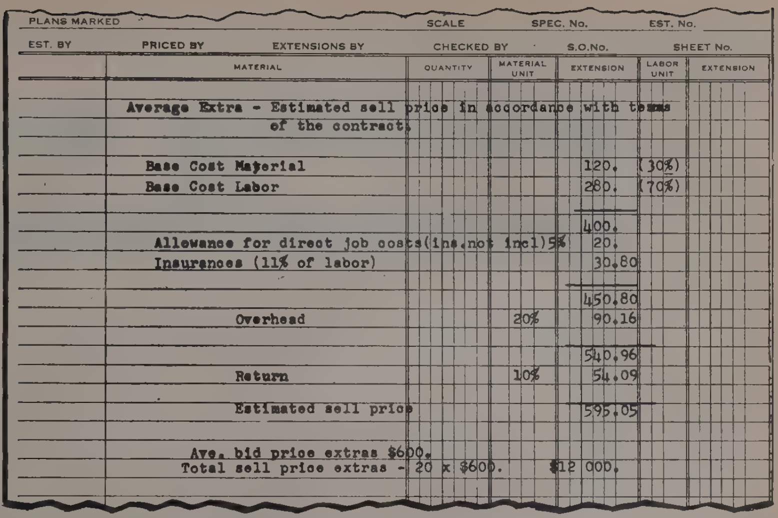
First, let's establish that the term extra (commonly used in the building industry) embraces all minor changes and additions. Large additions, which exceed 2% to 5% of the original contract price, are unusual and will not be considered in the types of contracts we are studying.

A contract without extras is better for many reasons. Among the more important ones are these:

1. The entire project moves smoothly when no changes are involved; and the duration is optimum.
2. Extras may (and frequently do) cause costly interruptions in the work of estimators, engineers, mechanics and others involved in expediting the work.
3. It is difficult to collect reasonable prices for "extra" work.

This will be discussed in a future article.

A change in the general contract may lead to extras. Any change in general construction tends to slow

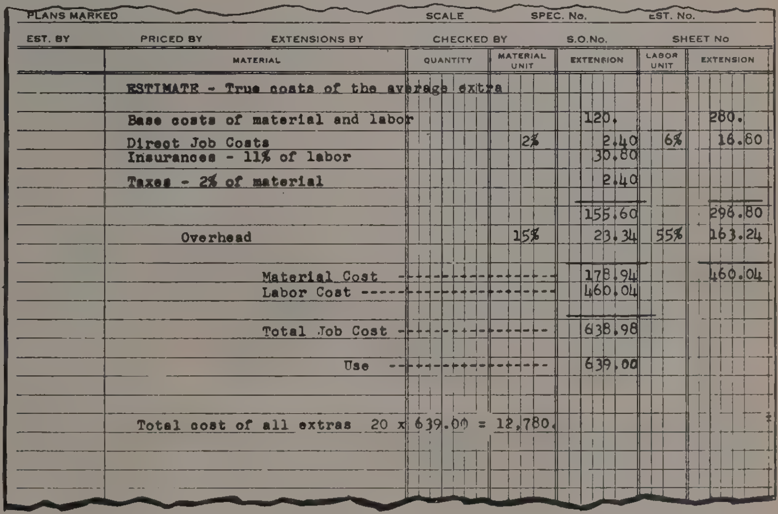


PLANS MARKED SCALE SPEC. No. EST. No.

EST. BY PRICED BY EXTENSIONS BY CHECKED BY S.O.No. SHEET No.

	MATERIAL	QUANTITY	MATERIAL UNIT	EXTENSION	LABOR UNIT	EXTENSION
	Average Extra - Estimated sell price in accordance with terms of the contract.					
	Base Cost Material			120.	(30%)	
	Base Cost Labor			280.	(70%)	
				400.		
	Allowance for direct job costs(ins.not incl)5%			20.		
	Insurances (11% of labor)			30.80		
				450.80		
	Overhead		20%	90.16		
				540.96		
	Return		10%	54.09		
	Estimated sell price			595.05		
	Ave. bid price extras $600.					
	Total sell price extras -	20 x $600.		$12 000.		

FIG. 2—Estimated selling price of average "extra" figured in accordance with original contract terms (overhead and profit percentages).



PLANS MARKED SCALE SPEC. No. EST. No.

EST. BY PRICED BY EXTENSIONS BY CHECKED BY S.O.No. SHEET No

	MATERIAL	QUANTITY	MATERIAL UNIT	EXTENSION	LABOR UNIT	EXTENSION
	ESTIMATE - True costs of the average extra					
	Base costs of material and labor			120.		280.
	Direct Job Costs		2%	2.40	6%	16.80
	Insurances - 11% of labor			30.80		
	Taxes - 2% of material			2.40		
				155.60		296.80
	Overhead		15%	23.34	55%	163.24
	Material Cost			178.94		460.04
	Labor Cost			460.04		
	Total Job Cost			638.98		
	Use			639.00		
	Total cost of all extras 20 x	639.00 =	12,780.			

FIG. 3—True cost of average "extra" figured on basis of appropriate overhead markups (separate) for small jobs. Note total cost is more than selling price in Fig. 2.

down the entire project. When this happens, the electrical work also drags. Extras and changes usually require a trip to the architect's office to secure the necessary information. The estimator then returns to his own office and prepares an estimate which is followed by a letter quoting a price and explaining the bid. Time and effort diverted in this manner also may result in costly interruption of other estimating and engineering work in the office.

When changes are contemplated, sections of the electrical work often are temporarily stopped. This may lead to shifting of mechanics to another part of the project, transfer to another job, or a lay-off. Any one of these moves is costly to the main contract, both from the standpoint of time and the effect it has on the interest the men take in their work. Only a few changes can be worked in with the regular contract to minimize extra cost. Most of them end up being costly.

Hypothetical Example

To substantiate and clarify the above statements, let's consider a hypothetical case study using approximate numerical values to illustrate our point. A base contract is let. Before it is completed 20 "extras" are added. Selling price of the extras ($600 each, average) was established by using the overhead markup of the original contract.

How did the contractor fare when the project was completed? To find out, study the details in Figs. 1 through 4.

Fig. 1 is the recap estimate sheet of the base contract showing a bid price of $97,100 and an estimated return of $6,572. Keep this in mind.

Fig. 2 shows an estimated quotation of $600 for the average extra. Markups used were in accordance with the terms of the original contract. The 20 extras added $12,000 to the original contract price, making the total selling price for the project $109,100.

Fig. 3 establishes an estimated true cost of $639 (excluding return) for the average extra; or a total cost of $12,780 for the 20 extras. Why should the average cost of each extra be greater than the $600 selling price shown in Fig. 2? The answer is simple. Allowances for markups stipulated in the original contract were not great enough for extras of such small size and with such low M/L (material/labor) ratios. With base material and labor costs of $120 and $280 respectively, the M/L ratio for the extras is 30/70. This is used in the example because, for small change orders, the cost of labor often outweighs the purchase price of the materials.

As indicated in Fig. 3, the appropriate separate overhead markups for jobs with a $400 base cost are: material, 15%; labor, 55%. The corresponding common markup for a $400 base cost job with a 30/70 M/L ratio would be approximately 44%. Compare this to the 20% common markup for overhead stipulated in the original contract and used (Fig. 2) for estimating extras.

To justify using a common markup of 20%, the contract should be near $4,000 with a 60/40 M/L; or $10,000 with a 30/70 M/L ratio.

Extended Duration

Fig. 4 lists all the costs, including overhead, of the completed project. The cost of the original contract (Fig. 1) was $90,528; of all the extras (Fig. 3), $12,780. To these must be added the excess labor, job and carrying costs caused by the change orders. That is the extra cost occasioned by extended duration—the delays resulting from the changes or extras.

(Continued on page 150)

Humidity and Condensation—VI

Ventilating the electrically heated home.

By W. J. Novak

THE installation of vapor barriers to avoid condensation of water vapor and subsequent structural damage to the well insulated house has been discussed. Since no vapor barrier is 100% effective even when perfectly installed, proper ventilation of the house interior to the outdoors becomes an important supplement to vaporproofing.

How does ventilation reduce moisture damage? Venting the living space and portions of the structure outside the living space aids in moisture control by (1) lowering the indoor vapor pressure, and (2) removing moisture-laden air from the ceiling, floor and wall cavities after it has penetrated or by-passed the vapor barrier. The principle by which incoming air lowers the relative humidity of the vented air is identical to that involved in accounting for the low relative humidities encountered in fuel-heated houses[1].

How is ventilation accomplished? Air may be removed by natural convection through specially designed and strategically located vent openings, or by forced ventilation using exhaust fans.

The series on humidity and condensation concludes this month with a discussion of humidity control through ventilation.

Readers are invited to express opinions or submit their own experience data on any aspect of electric heating. Please address correspondence to:

Electric Heating Forum
Electrical Construction and Maintenance
330 W. 42nd Street
New York 36, N. Y.

Reprints of this and all previous EHF issues may be obtained at the following prices:

1 to 49 copies: 20¢ each
50 to 100 copies: 15¢ each

Special reprints available:

- **"Electric Space Heating . . . 1960" by W. J. Novak, 50¢ each.**
- **"Electric Heat Can Cost Less," by Floyd Olson, 20¢ each.**
- **"Problems in Estimating Electric Heating Costs," by Glydewell Burdick, 15¢ each.**
- **"Estimating Floor Losses," by Glydewell Burdick, 15¢ each.**

Also available:

- **Automatic monthly mailing of EHF reprints in any quantity; write for details and prices.**
- **Attractive, colorful 3-ring binder designed to hold EHF reprints, $1.00 each.**

The kitchen exhaust fan is perhaps most familiar to the homeowner, since it has been extensively used to dispel odors and excessive heat from cooking. The direct exhaust to the outdoors from a clothes dryer removes moisture at its source, before it can affect the ambient air. Shower and bathroom exhaust fans are common for removing vapor from hot water to avoid condensation on mirrors and windows. These devices all serve to reduce indoor relative humidity.

Water vapor rising to the attic or roof cavity through the ceiling or partitions may be kept under control through the use of ventilating openings in the roof, eaves, or gable walls. Depending upon prevailing winds, outside air enters the attic at one end, driving attic air out the other. Or, air may enter eave vents and drive air out through gable vents or roof vents.

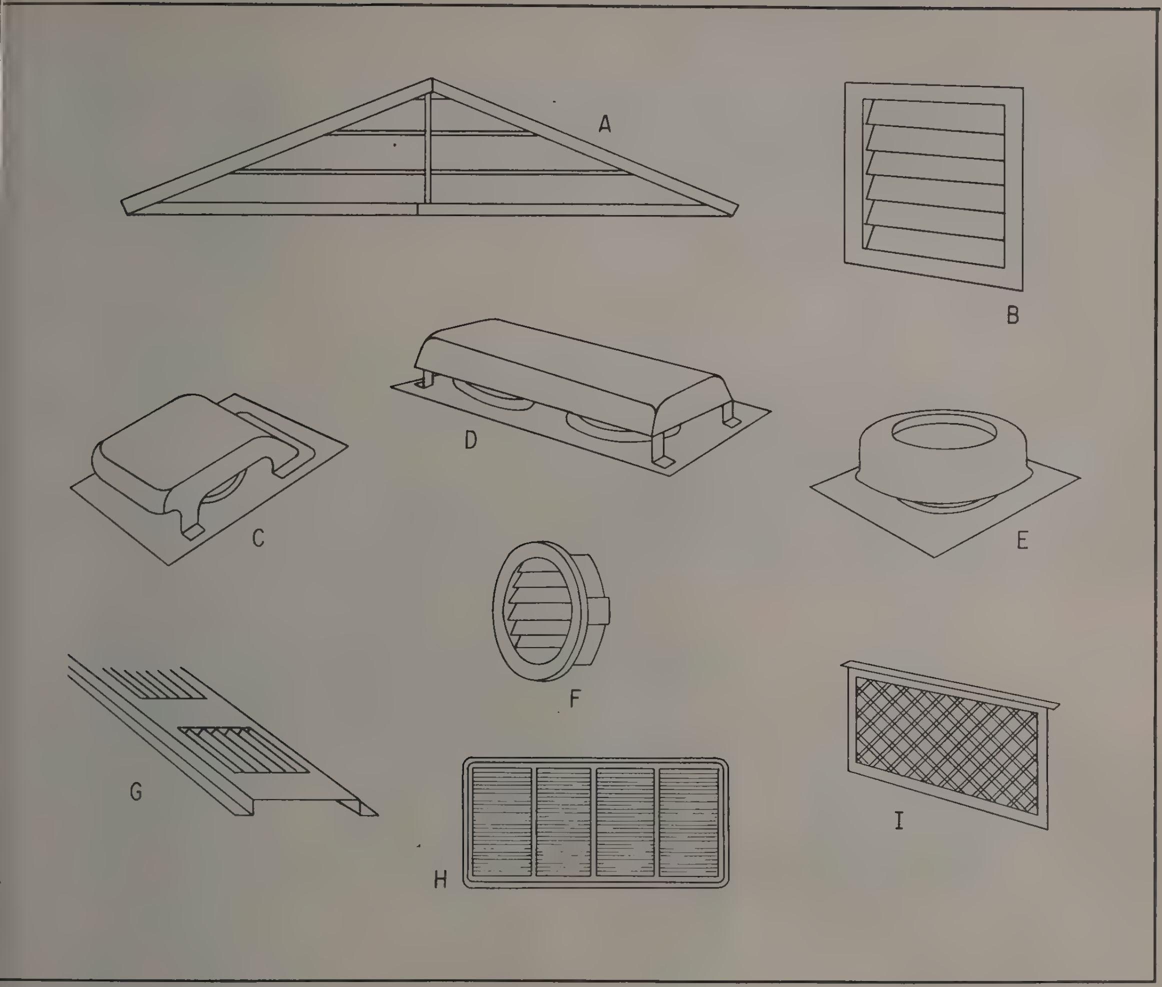
Walls are seldom ventilated in electrically heated houses, since vents would be required in each stud space; and stud spaces are usually filled with insulation. Where an air space exists inside the sheathing and for some reason the vapor barrier is inadequate, miniature ventilators may help at the top and bottom of each stud space. These small vents are available in diameters of 1 to 4 inches and are installed by first drilling the proper-size hole through the siding and sheathing and then tapping the ventilator in place with a hammer and wood block. However, without abundant circulation in the wall, it is likely that any benefit derived will be limited to the area in the immediate vicinity of the vent.

It has been stated that crawl spaces are most effectively vaporproofed by protecting against moisture both from the living space and from the earth. The crawl space itself then is bounded by vapor barriers, and foundation vents must be provided to permit the escape of vapor which accumulates despite the barriers. These are usually in the form of rectangular screened and louvered openings in two or more walls of the foundation.

How much ventilation is required? Since the function of the ventilation is to dissipate accumulated water vapor, it follows that the necessary rate of ventilation must be based on the amount of vapor expected in the space to be vented.

In the past, living space has been vented by the

Types and Uses of Ventilators



Triangle ventilators, fixed or adjustable, are available
fitting into peak of gable ends of attic for all roof slopes.
ects are barred by screen behind louvers. (B) Rectangular-
iped ventilators, also used in gable ends, are independent
roof slope. Louvers repel rain and snow. (C), (D) and (E)
of ventilators can be used on any sloping roof, are usually
talled near ridge or peak, and are especially effective when
ed in conjunction with soffit vents. (F) Miniature ventilators of 1-to-4-in. diameters may be tapped into drilled holes in walls or under eaves. (G) Vented strips, approximately 2 in. wide, are installed along entire outer edge of eaves behind facia strips. Narrow slots require no back-up screening. (H) Rectangular vents are spotted at intervals under eaves. Screening keeps out insects; some have ⅛-in. slots equivalent to 8-mesh screen. (I) Foundation ventilators of various designs, with or without covers and dampers, are set into foundation wall.

t-and-miss method of opening windows, the need
ing dictated by the presence or absence of conden-
tion on window glass. The function was also served
the pivoted flap and vent holes at the base of
ooden storm sash. The manually controlled kitchen
d bath exhaust fans provide a means for con-
olling moisture; however, the purpose is not always
lly served due to the unreliability of manual con-
ol. Many electrically heated houses today are pro-
ded with a humidistat to control the operation of
e kitchen or bath exhaust fan. The humidistat, nor-
ally mounted on a wall close to the kitchen or in
e shower room, is set for the desired relative hu-
idity and operates when this value is exceeded. A
-pass switch is usually provided to permit manual
eration of the fan for odor and smoke control.

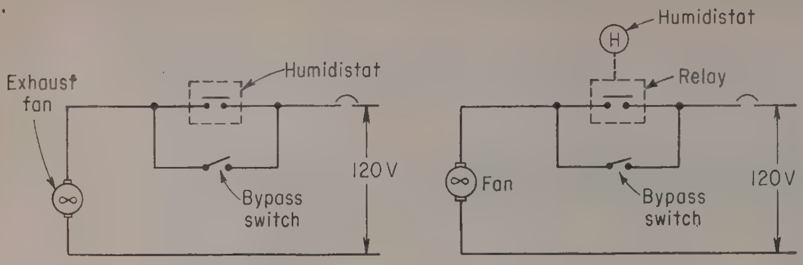
The air-handling capacity of exhaust fans is expressed in cubic ft per minute or more recently in terms of the floor area of the space they can ventilate effectively. Speed controls are available which reduce the capacity in 2, 3, or 4 steps.

The recently organized Home Ventilating Institute recommends that exhaust fans be of sufficient capacity to provide the following ventilation rates[2]:

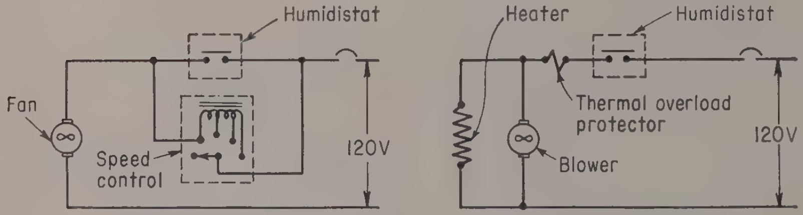
	Changes per hr
Kitchen:	15
Bath:	8
Family, laundry or rec room	6

In general, a kitchen fan plus one in each bath should suffice; the floor plan will usually dictate the location at which the humidistat will most effectively sense moisture conditions. If for some reason it is

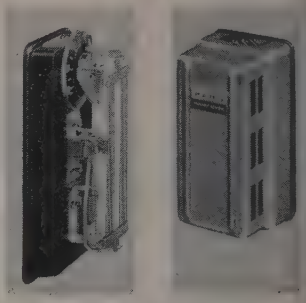
Wiring for Automatic Humidity Control



LINE VOLTAGE LOW VOLTAGE



SPEED CONTROL TEMPERED AIR



TYPICAL HUMIDISTAT

Exhaust fan may be controlled with line or low-voltage humidistat, usually bypassed by switch or speed control in range hood or on wall for manual operation. Blower controlled by humidistat may also be used to draw in outside air through heater and discharge it into living space.

impossible to vent the clothes dryer to the outdoors, the laundry room should have a fan also.

The size of vents in attic walls, roofs and crawl spaces is normally designated as a function of the area of the space to be vented. Ventilators are rated in "free area"; e.i., the area of opening exclusive of louvers, screen wire, etc. The free area required may vary with local codes and ordinances; however, the requirements of the Federal Housing Authority's Minimum Property Standards for one- and two-living units (last revised in July, 1959) are perhaps the most widely applied and accepted standard. The principal requirements are as follows:

For attics and spaces between roofs and top-floor ceilings: Cross-ventilation must be provided for each separate space using ventilating openings protected against the entrance of rain or snow. The ratio of total net free ventilating area to the area of the ceiling shall be not less than 1/150, with two exceptions. (1) The ratio may be 1/300 if a vapor barrier rated 1 perm or better is used on the warm side of the ceiling; or (2) the ratio may be 1/300 if both eave or cornice vents and vents in the upper portion of the space to be ventilated are used, with at least 50% of the required vent area located in the upper portion of the space, at least 3 ft above the eave or cornice vents. To be effective, there should be unrestricted openings for the circulation of air between the eaves and the upper portion of the space.

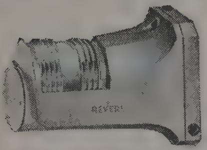
INSUFFICIENT VENTILATION in this attic caused condensation on roofing nails protuding through north roof slope, which turned to frost. Upon thawing, water dripped down into insulation.

Roof constructions which incorporate no air space and cannot be ventilated demand greater vapor barrier protection. In areas having a design temperature of 10F or lower, a vapor barrier having a permeance of not more than ½ perm is required by FHA to be installed near the warm side of the construction. Typical of such roofs are those where wood plank, fiberboard, or other roof deck material is also the finished ceiling surface. In addition, the joints at sides and ends of fiberboard deck must be designed to provide effective sealing of the vapor barrier.

For crawl spaces: Cross-ventilation must be provided by four foundation-wall ventilators, one at each corner of the space and having a total net free ventilating area not less than 1/150 of the area of the space. If the ground surface is treated with an approved vapor barrier, two such ventilators having a total net free area of 1/1500 of the space area will suffice.

How is the ceiling and crawl space area determined? The ceiling area used to determine the above requirements is the net surface area facing the roof which moisture may permeate, measured from the outside edges of the eaves, including any overhang. If the attic contains rooms with knee walls, the attic is subject to water vapor through these walls; hence the wall areas must be included. (See diagrams and examples.)

Similarly, crawl space area requiring ventilation is the total ground area of the space, measured to the outside of the foundation walls.


No. 3151-A Floodlight

Videst line of fixtures lets you achieve decorative lighting effects the one best way for each job

hen you plan an outdoor application for dramatic chitectural lighting, plan it the way you know is best r the job, then see your Revere wholesaler for the hting equipment required. From Revere's complete ne, you can select exactly the right fixtures to give the corative lighting effect you want.

Revere offers the industry's widest line of matched tdoor lighting equipment. For decorative lighting, or rking lots, or sports areas, or airports—or for virtually any outdoor application — Revere equipment lets you solve the problem the one *best* way. Whatever you need — hinged or rigid poles . . . mercury, incandescent or fluorescent luminaires . . . floodlights, fixtures, fittings — can be supplied by Revere in the size and types specified in your plans.

Ask your wholesaler about Revere outdoor lighting equipment for your next job. For a copy of Revere's catalog, write to us.

Revere ELECTRIC MFG. CO.®

OUTDOOR LIGHTING

Revere Electric Mfg. Co. • 7420 Lehigh Avenue • Chicago 48, Illinois (In suburban Niles)
Long Distance Phone: NIles 7-6060 • Chicago Phone: SPring 4-1200 • Telegrams: WUX Niles

Do the alternatives of 1/300 and 1/150 indicate that one is the equivalent of the other, and that more ventilation takes the place of the vapor barrier? Neither offers complete protection alone; use of a vapor barrier plus the required ventilation is recommended. There are cases where ventilation alone will not accomplish the intended result due to the direction of prevailing winds, the configuration of the roof, blocking of the vents by uninformed homeowners to conserve heat, moisture generation in the home in excess of the average, low moisture permeability of roofing materials used, etc.

On the other hand, complete dependence on vapor barriers would trap the small amount of vapor that does get through, which would condense on the coldest portion of the roof. An accompanying photo shows such condensation in the form of frost on the tips of roofing nails protruding into an attic space on the north slope of the roof. Upon thawing, the water drips down into the insulation or on articles stored on the attic floor.

Is ventilation the final answer to underfloor moisture problems? With excellent vapor barriers carefully installed on or below the floor of the crawl space to block earth moisture and on the warm side of the first-floor insulation to contain living-space moisture, it is very likely that the winter temperature of the air ambient to the floor joists, sills, etc., will be higher than the dewpoint of the crawl-space air. Condensation is therefore unlikely, hence the reduced ventilation requirement.

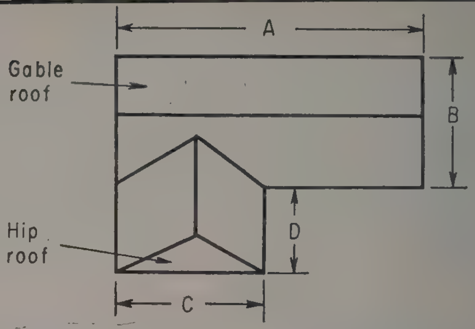
The house must perform equally well during the summer months, however. If the dewpoint of the outdoor summer air is consistently higher than the ground temperature, ventilating air will condense on the foundation walls and slab of the crawl space; and the relative humidity of the space could approach 100%. The same problem may be encountered in a basement during the summer if basement windows are kept open.

Successful results have been reported in the Upper Midwest, where such conditions prevail, with crawl spaces kept tightly closed throughout the year, using a portable dehumidifier in the crawl space to eliminate any moisture that does enter. This method has the added advantage of reducing floor heat loss during the heating season.

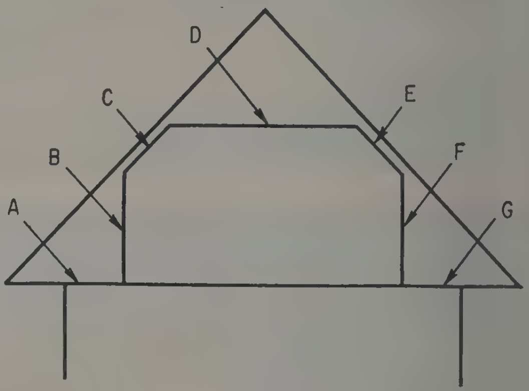
Undoubtedly, problems—and hence their solutions—vary with different climate conditions and with changing living-space conditions brought about by technological advances in the art of heating and cooling. Electric heat has done much to bring about intensive study of moisture conditions and their improvement. Search for the final answers to cover all situations must continue; and, most important, the information derived must be disseminated and put into practical use.

Is there anything new in the way of humidity-control equipment? An interesting and promising development is the automatic supply of tempered outside air to the electrically heated house. While an overwhelming majority of installations have proved to be completely comfortable with the natural convection provided by room heaters, there have been reported cases of stagnant air and excessive humidity brought on by tight construction. The humidistat-

Ceiling Area Requiring Ventilation



COMBINATION GABLE AND HIP ROOF
(Plan View)



GABLE ROOF: ROOMS IN ATTIC
(End View)

Sketches show roof areas which must be measured to determine required free ventilating area.

Example 1. In top sketch, two areas A x B and C x D must be vented. Assume A = 50 ft; B = 20 ft; C = 16 ft; D = 12 ft.

Total area:

$$50 \times 20 = 1000 \text{ sq ft}$$
$$16 \times 12 = 192 \text{ sq ft}$$
$$\text{Total} = 1192 \text{ sq ft}$$
$$1192 \times 144 = 171{,}648 \text{ sq in.}$$

Required free vent area, based on the 1/300 requirement, would be

$$\frac{171{,}648}{300} = 572.16 \text{ sq in.}$$

If an approved vapor barrier were used in ceiling, required free area would be half as great, or 286 sq in.

Example 2. In lower sketch, moisture can reach attic space from all lettered areas. Assume A = G = 180 sq ft; B = F = 180 sq ft; C = E = 75 sq ft; D = 240 sq ft.

Total area:

$$A + B + C + D + E + F + G = 1110 \text{ sq ft, or } 159{,}840 \text{ sq in.}$$

Required free vent area with vapor barrier used throughout would be

$$\frac{159{,}840}{150} = 107 \text{ sq in.}$$

In each case, the total required area could be supplied by two attic ventilators, one in each gable peak, by attic ventilators plus roof ventilators, or by any combination of attic and roof ventilators plus under-eave (soffit) ventilators. In Example 2, soffit ventilators should contribute a portion of the required area to vent the spaces behind the knee walls.

©1961 VOLKSWAGEN OF AMERICA, INC.

Does a Volkswagen ever get stuck?

We cannot tell a lie.

Yes.

Then why do you see so many of our trucks zipping through the snow when others can't?

Well, it's just a little harder for a VW to get stuck.

We put the engine in the rear.

The weight presses your drive wheels down that much harder on the snow, ice or whatnot.

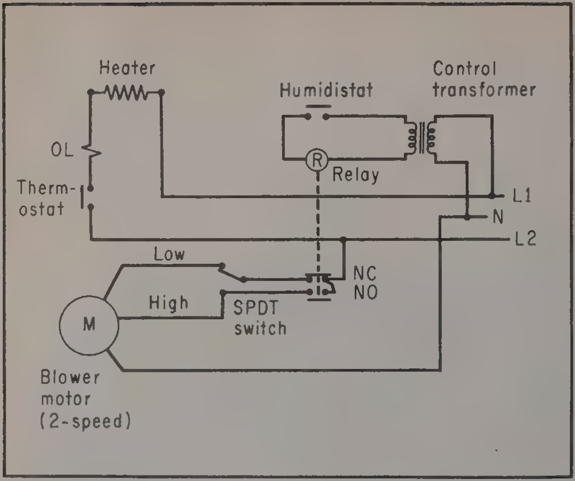
It's the extra traction that turns the trick.

Our air-cooling helps, too. Volkswagens have no radiator, no water to freeze. You always go.

Our winter performance is one reason the Mason Electric Company of Grand Rapids feels the VW is the truck for them. When snow socks in other makes, their VW gets through to the job—often even off the road.

Of course, another reason is that the VW's low operating cost—half that of a half-ton—also makes it easier to get through the end of the month.

Tempered Fresh Air



WIRING DIAGRAM shows one possibility of controlling tempered fresh air intake for winter humidity control. Blower operates continuously at low speed, supplying heated fresh air to living space. When relative humidity exceeds preset level, humidistat operates relay to connect blower high-speed winding. Manual switch permits bypassing of humidistat to provide high-speed operation for odor and smoke control as desired.

controlled exhaust fan described above is one solution. By exhausting the air, outside air is forced into the living space, increasing the rate of air change and thus alleviating both conditions. However, the opposite approach may be taken: outside air may be pulled in by means of an intake blower, filtered, heated, and introduced into the living space at a convenient location. If the amount taken in is equal to or slightly greater than that entering by normal infiltration, an increase in air change is accomplished by causing room air to *exfiltrate* to the outside through window and door cracks, etc., due to the buildup of pressure within the house. This method eliminates any discomfort which may otherwise be felt in the vicinity of doors and windows because of infiltrating cold air. Where a central electric furnace is the prime source of heat, the outside air could be introduced directly into the return air duct and mixed with the recirculated air in the desired proportion.

The intake blower may be operated continuously or it may be controlled directly by a humidistat with manual bypass switch, or by a time switch. The blower, filter, heater and discharge grill plus controls could be built into a complete unit to be mounted on an outside wall or ceiling. The air could be discharged directly or distributed to a suitable location by small pipe or tubing.

The temperature to which the air need be heated would depend more or less on where it was introduced to the living space. If the outlet were placed in a position to discharge air onto occupants, the air temperature would probably have to approach 100F or higher to eliminate the feeling of a draft, depending on the volume of air moved. On the other hand, if the air were introduced into a closet, basement, central hall, etc., temperatures in the vicinity of 70F may prove adequate.

Blower capacities could be determined directly from house volume and expected rate of infiltration. For example, assume a 9600-cu-ft house with a normal ½ air-change per hr. To duplicate this condition, the blower would have to take in 4800 cu ft per hr, or 80 cu ft per min. Of course, resistance provided by the filter or any piping or ductwork would reduce the actual capacity realized. Possible refinements include a modulating control to vary the heat output with the outdoor temperature, or a multi-speed motor.

Energy costs would increase only by the amount of electricity required to operate the blower motor, since the actual heating of the air would have to be accomplished whether drawn in by a blower or through natural infiltration.

The principle is not new; classroom ventilators are a much-used example. Some electric baseboard for home heating is being produced which is fed by ductwork to distribute outside air. Some tempered intake air units similar to those described above are being manufactured and installed in the West.

Such a unit would take care of excessive winter humidity. During the summer months, partial humidity relief is afforded by the air conditioner. Humidity has a way of being oppressive even when cooling is not needed, however. In some sections of the country, effective moisture removal is required for three times as many days as is cooling. Operating the conditioner for moisture removal on such days results in air temperatures too low for comfort. A separate dehumidifier is one answer, but frequently the capacities required are in excess of the largest capacity units currently available. More effective is the air conditioning unit with positive humidity control. Such a device, currently available from only a few manufacturers, uses the "reheat" principle to permit it to operate for the control of humidity on non-cooling days. The intake air is first cooled and dehumidified, then reheated to the desired room temperature level by a built-in electric heating element. By taking in outside air at the rate of ½ to 1½ changes per hr through an effective filter and mixing it with recirculated room air, continuous circulation of air may be provided to up to 8 changes per hr.

With complete electric heating and air conditioning, effective humidity control winter and summer, plus perhaps an electrostatic air cleaner to remove pollen, tobacco smoke and dust, the truly comfort-conditioned house results.

---

[1] See EHF No. 8, Feb., 1961

[2] See *Home Ventilating Guide*, Home Ventilating Institute, 1108 Standard Building, Cleveland 13, Ohio.

Bibliography on Humidity and Condensation

ASHRAE Guide and Data Book, 1961, Chapters 6, 8 and 9.

Remedial Measures for Building Condensation Difficulties, Bulletin 1710; Forest Products Laboratory, U. S. Dept. of Agriculture.

Moisture Condensation in Building Walls, Report BMS63; National Bureau of Standards, U. S. Dept. of Commerce.

Design Techniques for Controlling Moisture and Condensation in Building Structures; W. R. Meadows, Inc., Elgin, Ill.

Minimum Property Standards, Federal Housing Authority, Washington, D. C.

Moisture Problems in Crawl Space Houses; National Warm Air Heating & Air Conditioning Assn., Cleveland 14, Ohio.

Facts About Window Condensation and How to Get Rid of It; Anderson Corp., Bayport, Minn.

Let me tell you why these NEW BULLETIN 712 and 713 Combination Starters should interest you!

Bulletin 712, Size 1 combination starter with fused disconnect switch

They have — Smaller Size...Greater Switching Capacity... Greater Reliability...Longer Life...Complete Safety... Generous Wiring Room...Simple Design...Businesslike Beauty

Rating for rating, the new Bulletin 712 motor starter will outperform and outlast all others. Complete safety for the operator is assured because the cabinet door cannot be opened until the lever is moved to the OPEN position, which opens the visible contact disconnect switch.

The Bulletin 713 combination starter provides similar features for complete safety, but uses an ITE circuit breaker as a method of disconnecting.

Brooks Stevens, famous industrial designer, has given the entire line of enclosures, an undeniable "eye appeal"—an asset to any modern machine tool or industrial installation. Please write for details, in Publication 6100: Allen-Bradley Co., 1316 S. Second Street, Milwaukee 4, Wis.

BULLETIN 713
Combination Starter with Circuit Breaker in Nema Type 1 Enclosure.

19-61-RM

ALLEN-BRADLEY

Member of NEMA

QUALITY MOTOR CONTROL

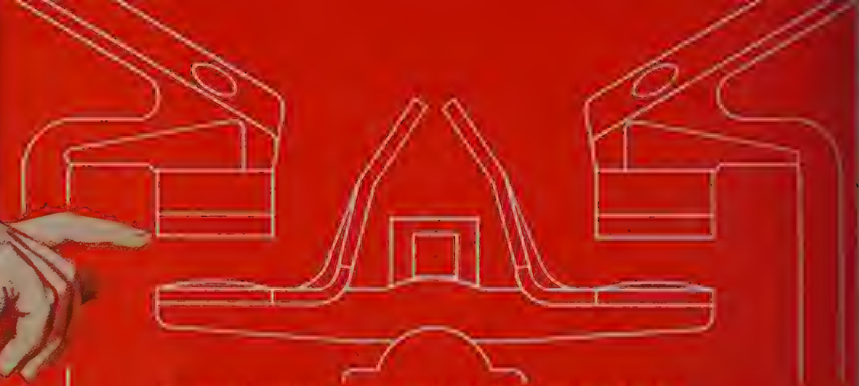


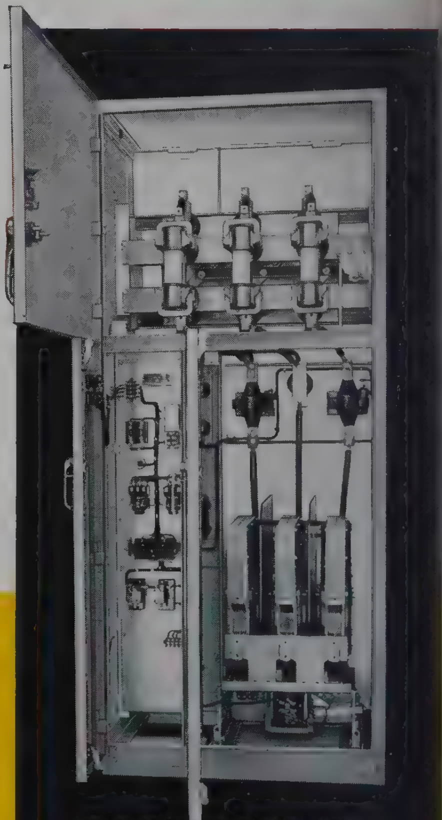
Diagram of contact arrangement in A-B high voltage starters (only 1 pole shown—not actual size)

Would You Believe That

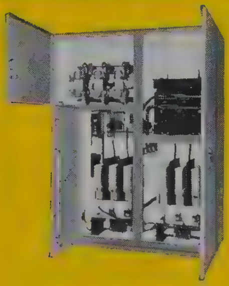
3/8 OF AN INCH IS THE REASON

for the Reliability and Long Trouble Free Life of A-B Starters Rated at 1500 hp, 2300 v; 2500 hp, 4600 v!

Allen-Bradley high voltage starters were designed and are built to provide millions of trouble free operations. An astounding claim—for this class of apparatus—but *true!* The extraordinary performance of the air break contacts is the result of extremely short contact travel—only 3/8"! Naturally, such short travel reduces pounding and contact wear to a minimum. Also, the famous Allen-Bradley solenoid principle of operation is so simple that nothing can go wrong. Maintenance-free, double break silver alloy contacts are used throughout. Allen-Bradley high voltage starters are available for all types of motors and all types of service. For full details please write today for Bulletin 6080 to: Allen-Bradley Co., 1316 South Second Street, Milwaukee 4, Wisconsin.

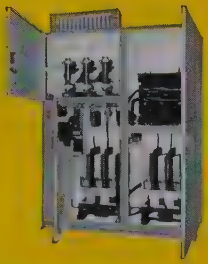


Bulletin 1159, Full Voltage Induction Motor Starter



Bulletin 1172, Reduced Voltage Induction Motor Starter

Bulletin 966, Full Voltage Synchronous Motor Starter



Bulletin 983, Reduced Voltage Synchronous Motor Starter

19-61-RM

ALLEN-BRADLEY

QUALITY MOTOR CONTROL

Facilities for a Trailer Country Club

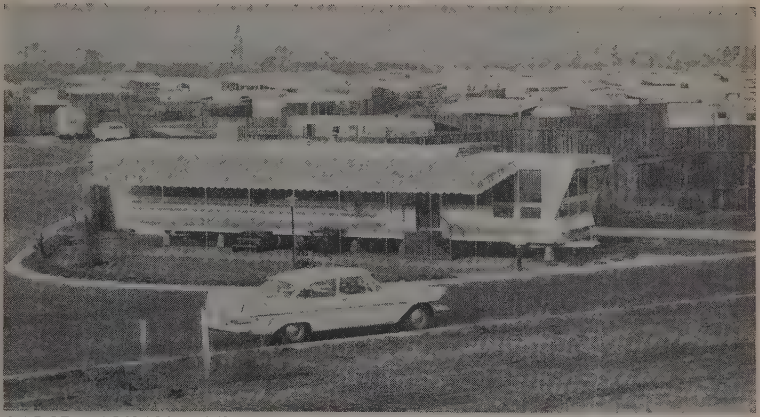
IN MORE ways than one, America is a country "on the move"—a fact evidenced by the great number of trailer courts defining many of our metropolitan areas. And every day these courts are becoming more deluxe, providing not only parking space and basic conveniences, but complete service facilities, shopping and recreational centers as well.

Take, for example, a recently opened large-scale development near San Jose, Calif., appropriately named the Mobil Country Club due to its general residential character, central recreation hall, swimming pool, food and drug stores, library, cocktail and TV lounges, gas station and street lighting. All such units are designed and landscaped to enhance and unify this sizable venture. Curving roadways and ornamental lamp posts further promote the impression of a rural community, while each individual lot is amply dimensioned to accommodate the largest mobile home, a concrete apron for a passenger car, plus space for a small lawn, garden or play area as well.

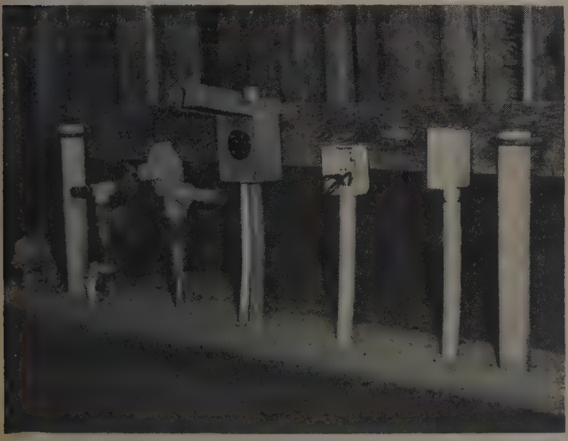
Individual lots also are provided with complete service facilities including weatherproof plug-in receptacles for 120/240-volt 3-wire power, coaxial TV taps connected to a master antenna array, connections for telephone service, electric grounding cables and clamps, also water service, domestic waste and natural gas lines. These facilities are neatly aligned adjacent to trailer pads so that short flexible connecting cables, conduit and hose lines can be established quickly, conveniently, safely and compactly.

Metering and main switches related to these services are remotely grouped in multiples of six. Stubbed-up conduit and related panels and enclosures are located along redwood lot-intersection fence lines so as to remove them from obvious view and also to simplify monthly reading and billing routines. And, since all feeders and mains are carried underground, the entire development is devoid of utility poles, transformers or wires.

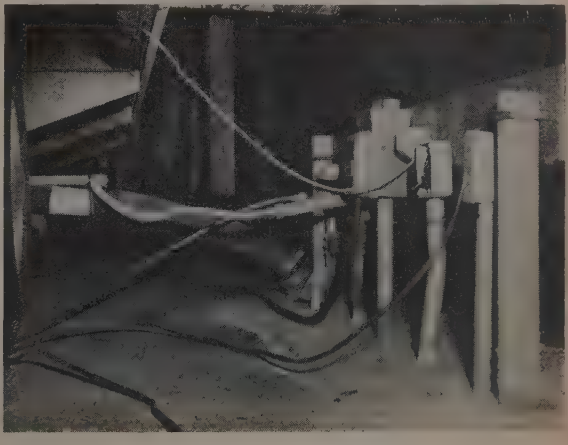
Primary power for this mobile-home center likewise is obtained underground, with pad-mounted ventilated 167-kva transformer and distribution units receiving initial



LARGE PARKING AREA accommodates deluxe mobile home, while separate driveway for pleasure car, log-defining redwood fence, ornamental lamp post, attractive landscaping and curving roadways further create impression of rural community. Note absence of utility poles and overhead wiring. Convenient recreation and shopping center is located just a few hundred yards to right of this photo.



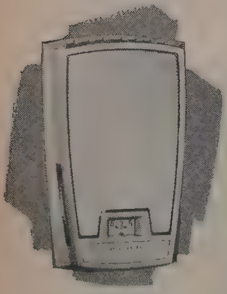
ARRAY OF UTILITIES for each individual lot includes weatherproof 60-amp twistlock 120/240-volt power outlet to serve major electrical appliances, two separate polarized grounded-plug 20-amp 120-volt outlets, a coaxial connection related to a master antenna TV set-up, a telephone outlet, also water and gas service plus domestic waste disposal facility.



MOBILE HOME (wheel and body-overhang visible at left of photo) is parked conveniently to utility rack so that flexible cable, conduit and hoseline connections are short, neat and easily established. After connections are completed, utility rack can be shielded from general view by ornamental enclosure or roll-away planter units.

Type 842
Humidity
Control

Electrically-heated homes
NEED humidity control

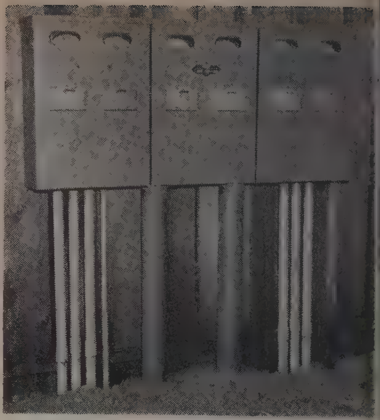


Penn "Click" Dial Electric Heat Thermostat responds faster and holds temperature closely to selected level.

Well-insulated, electrically-heated homes tend to hold high levels of humidity. This condition causes condensation on windows, cold surfaces and possible penetration of moisture in insulation which may reduce insulating efficiency.

To solve these problems, and also assure more indoor comfort, more and more contractors are installing the Penn Type 842 to control the kitchen exhaust fan. Then, when humidity is excessive, the fan is started automatically to exhaust moisture-laden air thus reducing relative humidity. Use automatic humidity control as a selling feature for electric heat . . . your customers will appreciate the many advantages it gives them! Write the Penn factory for specific information.

PENN CONTROLS, INC. Goshen, Indiana
MEDALLION HOME LIVE BETTER ELECTRICALLY
EXPORT DIVISION: 27 E. 38th ST., NEW YORK, N.Y.
AUTOMATIC CONTROLS FOR HEATING, REFRIGERATION, AIR CONDITIONING,
APPLIANCES, PUMPS, AIR COMPRESSORS, ENGINES



MAIN SWITCHES and meter panels are centralized in groups of six along redwood lot lines in order to simplify reading and billing routines. Note relatively large-diameter up-stubbed main feeders in center with smaller sub-distribution branch lines returning underground at either side of this compact panel arrangement.

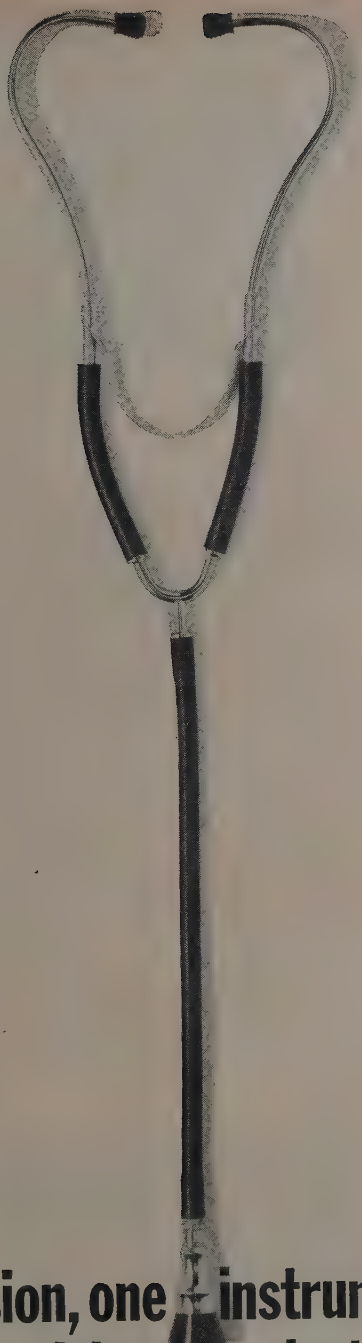
PRIMARY SERVICE at 12-kv is delivered underground to ventilated pad-mounted interrupter-switch cubicle related to 167-kva transformer and 120/240-volt single-phase 3-wire secondary distribution section. Enclosure also contains astronomic time switch for automatically controlling street light circuits.

3-phase 4-wire utility service at 12 kv, then stepping it to single-phase 120/240-volt 3-wire for general underground distribution to local meter and switching assemblies.

This electrical installation was by Roy M. Butcher of San Jose.

Electric Heating For Hangar Doors

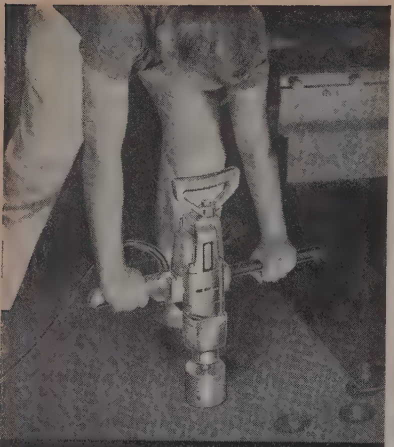
Despite the severe winter, frozen hangar doors are not preventing fast airplane take-offs by American Can Company executives. The hangar used by the company at Westchester County, New York,



In every profession, one instrument gets to the heart of the problem quickest, easiest, and most accurately. Amprobe is the stethoscope of the electrical industry

The Amprobe RS-3* enables you to take voltage, current and resistance readings to help diagnose electrical "ills." It saves you time and effort; it adds to your reputation for ability and service. Here are a few typical applications. Ask your distributor or write today for more details: ■ determine current loads of power equipment ■ make commercial and industrial load surveys ■ identify unmarked motor terminals ■ test for low-voltage conditions ■ check resistance in solenoid coils. *Only $52.50 (slightly higher outside U.S.).

AMPROBE INSTRUMENT CORPORATION
630 MERRICK ROAD, LYNBROOK, NEW YORK
CANADA: ATLAS RADIO CORP., 50 WINGOLD AVE., TORONTO

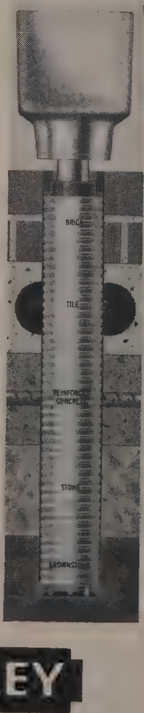


... even through REINFORCED CONCRETE

NEW! STANLEY No. 404 IMPACT DRILL

out-performs any portable drill or hammer cutting through reinforced concrete, brick, rock, masonry.

Faster cuts mean time saved on each job. Cleaner cuts eliminate costly post-installation repairs. No. 404 Impact Drill produces straight smooth cylindrical holes without chipping, fracturing, breaking or spalling the material. Cuts precise openings for pipes, conduit, cables, dowels, anchors, etc. High-frequency impacts, combined with high-speed rotation, create a non-destructive, disintegrating action. Drills any masonry material, even reinforced concrete! RANGE: 3/16" to 4" diameter holes. WEIGHT: Only 25 lbs. Bores to extreme depths! See it at your Supplier's, or write Stanley Electric Tools, Division of The Stanley Works, 8711 Myrtle Street, New Britain, Connecticut.



STANLEY

STANLEY ELECTRIC TOOLS
Division of The Stanley Works
NEW BRITAIN, CONNECTICUT

ELECTRICALLY POWERED heating unit (at left of hangar partition) supplies hot oil into pipes beneath the rails of sliding hangar doors to prevent icing.

Airport has a completely packaged electric heating unit that goes into service as soon as icing conditions are predicted. The unit is applicable wherever frozen doors hamper transportation or industrial operations.

Executives of American Can's Canco Division may be called to any one of 100 plants or offices scattered throughout the country at a moment's notice. To avoid delays due to icing conditions at the hangar, Canco has installed a 48-kw, 160,000 Btu per hour fluid heat transfer unit.

Canco chose an electric heating unit for this job in preference to oil-fired equipment because of compactness, safety and ease of installation. Oil-fired equipment would have required construction of a special platform to keep it off the floor since non-electric heating equipment operating at floor level could constitute a fire hazard.

The unit, manufactured by Hynes Electric Heating Company was delivered as a complete package and was readily installed. It connects with pipelines embedded in concrete just under the hangar door rails. Four lines of 1½-in Schedule-40 steel pipe beneath the rails form a pipe coil through which hot oil is circulated.

Oil heated to 85° F keeps the temperature of the rails and adjacent areas well above the freezing point. The heater keeps the oil recirculating through the system.

The heater is used only when icing conditions are prevalent or predicted. When icing conditions are forecast, the heater is started up manually several hours in advance of the expected arrival of bad weather. By the time freezing conditions have developed, the hangar door rails and adjacent areas are already heated well above the freezing point.

OUTDOOR PATIO HEATING, using electric radiant heaters, extends the outdoor living season in Seattle, Wash., from late spring to mid-October. The 320-sq-ft patio shown uses eight 1000-watt Rumar heaters, or 25 watts per sq ft. Some units are mounted overhead at an angle to radiate downward into the living space; others are installed less than 2 ft from the floor level. Installation cost was $700; cost of operating all 8 units of prevailing all-electric rate of 1.2 cents/kwhr is 9.6 cents per hr.

This marker frees one man from tracing cables

The Amprobe Cable Tracer* enables you—by yourself—to trace ten uncoded circuits simultaneously ten times faster than any other method. Simply plug one end of the conductors to be traced into the markers (there are ten of them), the other ends, in pairs, into the pocket-sized Cable Tracer, press the button, and a number lights up to provide unmistakable identification. See your distributor or write today for more details.

Here are some typical, broad category applications:
- Trace commercial and residential conduit wiring.
- Identify circuits in intercom and p.a. equipment.
- Trace multi-conductor cables in control circuits.
- Correct errors in labeling on panel boxes.
- Test for opens and shorts.

*$39.50 (higher outside U. S.).

AMPROBE INSTRUMENT CORP.
LYNBROOK, NEW YORK

IN CANADA: ATLAS RADIO CORP., 50 WINGOLD AVE., TORONTO

Good contractors install M

No other cable offers the speed, the economy, the safet that Mineral Insulated Cable gave to this service statio remodeling...No other cable fits such a wide variety o 600-volt-and-under applications...No wonder more and mor

1 Stripping MI Cable for termination. Next: lay cable, make junctions — and you're done! **2** MI leaves explosion-proo junction box. Bends and offsets are hand-made — without a hickey. **3** Sand-filled breakaway service station islan being rewired with MI. Rugged, solid MI virtually eliminates problems of moisture, freezing, explosion. It is rigid – stands free as shown... but so flexible a free length remains in pump base, permits easy offset to junction bo regardless of location. **4** MI Cable meets pump junction box. Termination is Type H — special for hazardous locations

1

2

Cable for service stations, too

ontractors bid more and more jobs on the basis of MI Cable!
e sure you have on hand all the latest MI information.
rite General Cable for your copy of Catalog S-2. General
able Corporation, 730 Third Avenue, New York 17, New York

RE'S WHAT MI CABLE MEANS TO YOU: SAVES TIME Just train cable from power to use, and terminate. That's all! EASY TO
E because MI is lighter, more flexible, about half the OD of equivalent conduit. FLEXIBLE — RIGID Train MI by hand — it keeps its
ofessional look with few supports. RESISTS HEAT Continuous use: 185°F...special applications: 482°F...short duration: up
melting point of the sheath. RESISTS MOISTURE, VAPOR Liquids and gases can't pass along MI's solid core, nor penetrate
sheath. NEC APPROVED for general use in Article 500 of Amended 1956 NEC. Many other regulating bodies have approved
, including for use in hazardous locations. WIDE VARIETY Comes in 1, 2, 3, 4, and 7/C — In all regular AWG conductor sizes.

GCC
GENERAL CABLE CORPORATION

In the time it takes this to make 1 hole in concrete

this makes 5 permanent fastenings

The timesaver on the right is called Shure-Set.® Instead of making holes in concrete (slowly) it makes permanent fastenings (quickly). This easily. Insert a Shure-Set fastener in one end. Strike the other end with a hammer. Less than 5 taps and the fastener permanently anchors a 2 x 4 — or a duct strap, or a junction box, or most anything — to concrete. No drilling. No expansion devices. No powder charge. And no sweat. If your time is money — Shure-Set saves a lot of both — it'll pay for itself first day out on the job. Shure-Set tools and fasteners are available from your local Ramset or Shure-Set dealer. He's listed in the Yellow Pages, under "Tools."

Ramset WINCHESTER-WESTERN DIVISION **Olin**
285-K Winchester Ave., New Haven 4, Conn.

Pump-Test Facilities Expand Shop Service

IT IS easier to sell equipment when you can back up a sale with repair and test facilities to handle customers' service requirements. That's a basic philosophy at Kirby Risk Electric Motors, Inc., Lafayette, Ind. And it is paying off. Sales manager Stan Newhard and vice president and shop supervisor G. F. Buschman confirm a boost in sales and improvement in customer confidence and business relations.

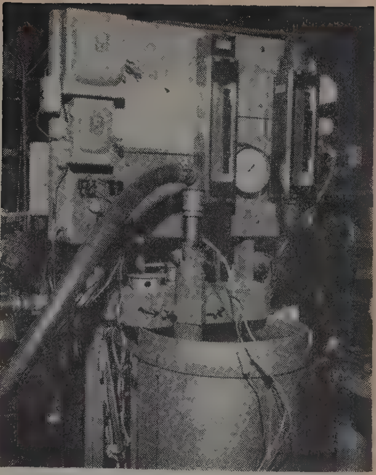
Submersible water pumps are a good illustration. When the Kirby Risk firm took on a line of pumps, they set up a separate test and repair department to service this type of unit. Now, in addition to repairs, they sell from 600 to 800 new pumps per year.

Test equipment is installed at one end of the repair bench. It consists of an open tank (60- to 80-gal capacity) with piping for water recirculation and the necessary gages and meters to record pump performance. Gages, meters and pump motor controls are mounted on a panel above the tank. A special mounting block securely anchors the pump after it has been immersed in the tank. A hose connection ties the pump into the piping system. Pumps being dismantled are held in a hinged-collar vise mounted to a floor pedestal. Special tools, parts and supplementary test equipment are on the adjacent repair bench.

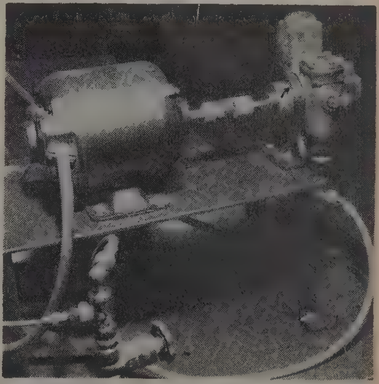
Directly opposite the water-pump service department is a fuel-oil pump test and repair stand. This additional service supplements normal oil-burner-motor repairs. Test rack, repair facilities and spare parts storage are all concentrated on one bench. Mounted on a bench backboard are the pump motor control and vacuum and pressure gages to measure pump performance.

The test rack consists of a metal pedestal supporting a driving motor at one end and a fuel pump bracket at the other end. Pumps slide into the bracket collar and are anchored by set screws. After pump shafts are coupled to the motor and all line connections made, the units are ready for test. The pedestal rests in a metal drip-pan. Both are bolted to the top of the metal bench.

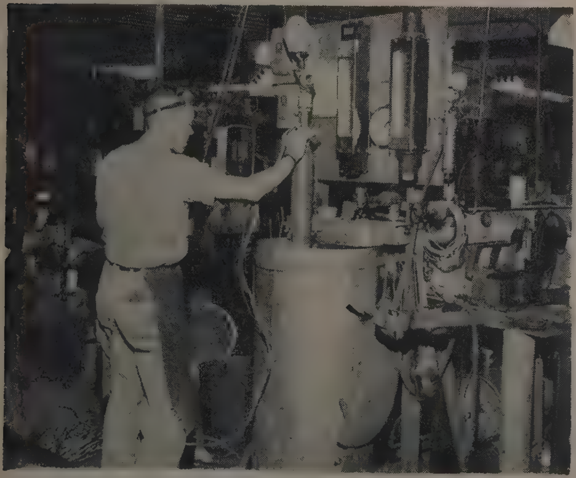
Since the addition of the fuel pump test department, repairs in this category have been increasing and are now running between 200 and 300 jobs per year. Kirby Risk management likes the way the department is working out and customers like the one-step convenience of having motors and pumps checked and repaired in one shop.



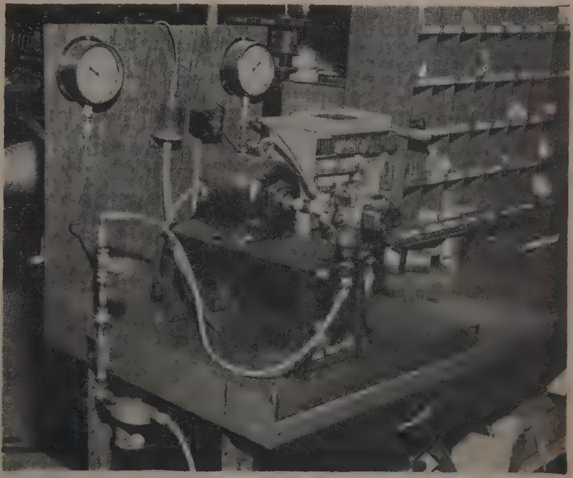
TEST PANEL above tank holds motor controls, pressure gage and flow meters. Hose connects pump to water recirculating system. Note V-block bracket (arrow) supporting pump under test.



PUMP PEDESTAL supports drive motor and pump bracket (arrow). Set screws anchor pump in collar. Coupling arrangement accommodates various shaft lengths and sizes.



SUBMERSIBLE PUMP TEST department at Kirby Risk Electric Motors shop. Mechanic uses chain hoist to lower unit into test tank. Vise (arrow) holds pumps during disassembly.

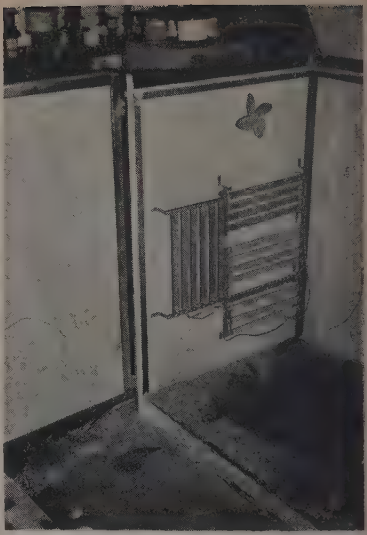


FUEL PUMP TEST stand combines test rack, gages, parts storage and work space on single bench. Drip pan under test rack collects any spillage from oil lines.

The *right* extension cord is essential for safe, dependable operation of on-the-job equipment and temporary lighting . . . the *right* size to carry the load, the *right* length to supply the power without voltage drop. That's why there's a Royal heavy-duty POWR-KORD to fit *every* job. Available in one quality (the very best) . . . two types (rubber and vinyl) . . . three colors (red, black, yellow) . . . four wire sizes (12, 14, 16, 18) . . . and over five handy cord lengths (10 to 100 ft.). See your wholesaler. He has the facts — and Royal POWR-KORDS in stock, ready for your work.

ROYAL ELECTRIC
... an associate of ITT

ROYAL ELECTRIC CORPORATION
PAWTUCKET, RHODE ISLAND
In Canada:
Royal Electric Company (Quebec) Ltd., Pointe Claire, Quebec



ELECTRIC STRIP HEATING UNITS, small fan, thermostatic bulb control, good insulation and multiple hinged construction of oven are features of this practical shop-made baking facility.

Electric Bake Oven Features Hinged Top

Standard Electric & Engineering Co., San Francisco, has a shop-made oven with several unique features, such as a hinged top as well as a hinged door, thereby permitting units to-be-baked to be crane-lowered into the enclosure from above, as well as wheeled into postion on dollies. Since the oven is formed from asbestos-gasketed Transite panels backed by 3-in.-thick insulation, heat emission from the oven to the shop proper is negligible. And, since heat from wall-mounted electric radiant strips is regulated by thermostat and circulated by a small wall-mounted fan, temperatures maintained within the enclosure are constant and even as a result.

Compact Spray Booth Has Equipment Variety

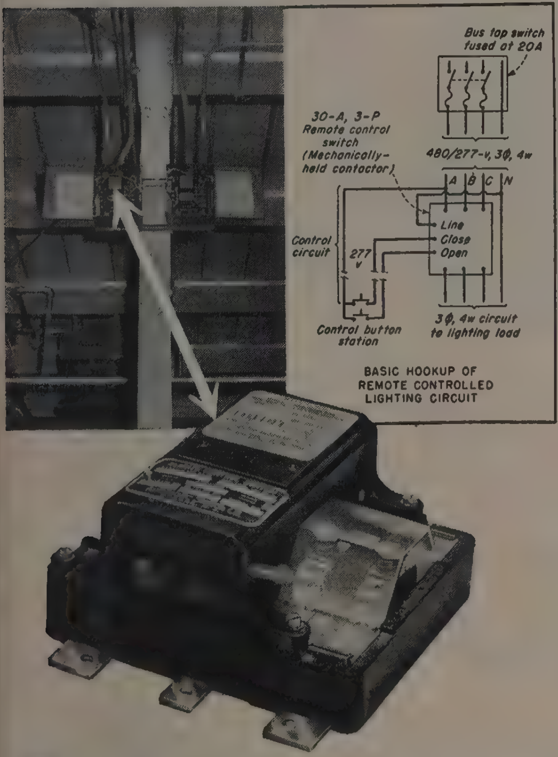
Buzzell Electric Works, San Francisco, has a well-equipped shop which includes a compact spray booth containing a solvent tank equipped with fusible-link gravity-closing cover, compressed air facilities for cleaning motors by blowing or applying solvent in spray form, also an assortment of paint and enamel-applying containers and nozzles. Since rolling motor cradles can be brought directly into the booth, and since heavy equipment can be moved into position by a

The case for 277 volt lighting and ASCO Remote Control Switches

AT THE NEW ASCO PLANT . . .

Remote Control Switches for feeders and branch circuits greatly simplify load control. Fast and reliable on-off control over large blocks of 277 volt lighting can be exercised from any control point.

ASCO Bulletin 920 Mechanically Held Remote Control Switches (shown mounted on a column) control large blocks of lighting in the manufacturing area. Control is by pushbutton from a convenient point.


Bus top switch fused at 20A
30-A, 3-P Remote control switch (Mechanically-held contactor)
480/277-v, 3Ø, 4w
A
B
C
N
Control circuit
277 v
Line
Close
Open
Control button station
3Ø, 4w circuit to lighting load

BASIC HOOKUP OF REMOTE CONTROLLED LIGHTING CIRCUIT

The Bulletin 920 Remote Control Switch is U. L. approved to 600 Volts A-C, and is catalog listed in sizes from 30 to 200 amperes, 2 and 3 pole.

Use of the 277/480 volt Wye system and development of the 277 volt discharge lamps were made possible by the 1953 Code. Section 2113 extended the higher voltage branch circuits as follows:

> "Section 2113, Voltage. (2) in Industrial establishments, office buildings, large schools and stores, the voltage of branch circuits which supply only the ballasts for electric discharge lamps in permanently installed fixtures mounted not less than eight feet from the floor, which do not have manual switch control as an integral part of the fixture, may exceed 150 volts to ground, but shall not exceed 300 volts to ground."

The expanded use of 277 volt lighting in office buildings, factories, stores, schools, and technical centers results from the many advantages of this system:

1. Reduction in number of circuits—since loads can be combined
2. Reduction in wire sizes
3. Increase in the number of fixtures per branch circuit (2.3 times 120 volt systems)
4. Use of same system for both power and lighting

Substantial blocks of 277 volt lighting can be controlled remotely through the use of ASCO Remote Control Switches, providing these advantages:

Installation Economy—Distribution panels can be located to provide straight feeders and short branch circuits, resulting in minimum line drop and losses.

Control Convenience—Control stations located conveniently—connections made using small wires provide instant disconnect of lighting and power feeders.

Design Simplicity and Flexibility—Logical distribution determines design—makes wiring layout simple and flexible for future expansion.

Safety in Emergencies—Instant control of vital circuits from one or more accessible locations.

And ASCO Remotes can be used up to their full rating on 277 volt fluorescent loads.

DEPENDABLE CONTROL BY ASCO

ASCO Mechanically Held Electrically Operated Remote Control Switches are ideal for 277 volt lighting applications. ASCO Remotes are unaffected by line voltage conditions, and respond only to the control of the pushbutton, time switch, relay or other controlling device. These switches are available from 30 to 1000 amperes—to 750 volts A-C or D-C—for all classes of load.

For complete engineering information on Remote Control Switches, write for new Catalog 57-S2.

ASCO Electromagnetic Control

DEPENDABLE CONTROL BY Automatic Switch Co. 50-J HANOVER RD., FLORHAM PARK, N. J. • FRONTIER 7-4600 • *AUTOMATIC TRANSFER SWITCHES • SOLENOID VALVES • ELECTROMAGNETIC CONTROL*

DEPENDABILITY

The "SCOTCH" Brand Electrical Tape No. 33 used to wrap splices on this control panel provides safe, dependable insulation at minimal cost. It conforms perfectly to small wires, applies easily in cramped areas, helps prevent costly production line breakdowns. When tape costs so little, can you afford less than the best?

BALANCED FORMULA IS THE SECRET: Whatever the task, you can depend on "SCOTCH" Brand Electrical Tape No. 33. Its perfect balance of physical properties provides the ultimate in holding, protecting and insulating all in one wrap. Strong, stretchy, it has the perfect "feel" to get jobs done faster, done right. Tough vinyl backing shrugs off moisture, sunlight, heat, cold and other adverse conditions. Pressure-sensitive adhesive adheres instantly, holds permanently, without creeping or end-lifting. Low power-factor provides excellent insulation . . . high electric strength, wet or dry. For every job you can put your confidence in "SCOTCH" Brand Electrical Tape No. 33.

FIRST and still the best

MINNESOTA MINING AND MANUFACTURING COMPANY
. . . WHERE RESEARCH IS THE KEY TO TOMORROW
3M COMPANY

"SCOTCH" is a Registered Trademark of 3M Co., St. Paul 6, Minn.

STURDY MOBILE CRADLE supports armature in corner of compact spray-booth while final paint touch-up is completed with handy pressurized applicator. Good lighting and exhaust provisions improve working conditions.

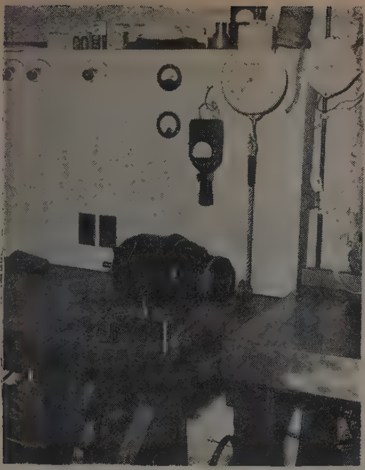
monorail hoist, the equipment-handling chore is an easy one. And, since the booth is also equipped with vaporproof lighting fixtures and a high-capacity exhaust system, the atmosphere within this enclosure remains fresh, clean and safe.

Test Bench Has Built-in Prony Brake

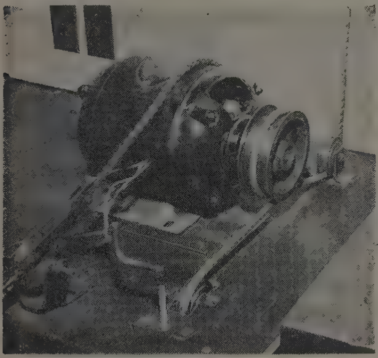
A simple prony-brake assembly incorporated in the test bench at Tweedie Electric Motor Service, Lafayette, Ind., is used to load-test small motors. Basic equipment consists of a scale, a 4-¾-in. flat-steel brake pulley with retention-rims welded to the sides, a length of ⅜-in. Manila rope, rope-guide pulleys on the bench top, a threaded rod to apply tension, a chain vise to hold the motor, and a clamp-on ammeter to indicate motor current.

The rope goes under a bench pulley directly beneath the scale, is looped once around the brake pulley mounted to the motor shaft, goes over an inset pulley near the front edge of the bench and drops down. One end of the rope is attached to the scale hook; the other to a threaded clamp on the vertical tensioning screw. The screw is a 3-ft length of 5/16-in. steel rod threaded full length and supported by threaded anchor nuts welded to a ¾-in.-steel-channel upright. The top of the screw extends through the metal bench top and is capped with a handcrank.

A roller-chain vise anchors test motors securely to the bench top



TEST BENCH with built-in Prony brake at one end. Scale indicates load applied by friction brake; clamp-on ammeter shows motor current at various loads that are mechanically connected to the motor drive shaft.

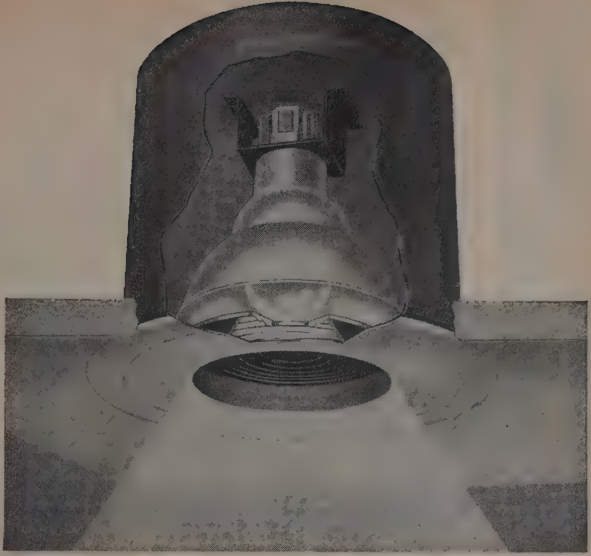


PULLEY ALIGNMENT for rope brake. Load is applied by turning tension screw in foreground. Note how chain vise anchors motor.

and stop-rail. A hook-clamp attached to lever-operated cam provides positive locking and chain adjustment.

With the motor running, brake pressure is applied by turning the tension screw clockwise. This puts a downward pull on the rope. A reverse motion releases the brake. Applied torque can be read on the scale. Motor current at various loads is indicated by a clamp-on ammeter supported by a spring clamp on the bench panel. Ammeter prongs clamp around a cable loop connected in series with the test leads. When not used with the prony brake, the meter has numerous other applications in the motor shop.

With the foregoing test procedure, it is possible to check all reconditioned, fractional horsepower motors at a single location, in addition to simplifying and speeding up the final tests.



Regressed Lens Downlights with Designed Optics by Kliegl

. . . the Great Name in Lighting!

Designed Optics . . . properly controlled general area illumination from a concealed lens downlight. Using a specially designed hidden lens support cone and a Fresnel Lens with black painted risers, Kliegl Regressed Lens Downlights give a soft illumination without side glare or surface brightness.

Kliegl Regressed Lens Downlights are optically designed to give excellent performance and easy maintenance. A special flush face plate design produces the distinctive "clean look" when installed.

Plan to use Kliegl Regressed Lens Downlights on your next project. For complete information, write for our Architectural Lighting Catalog.

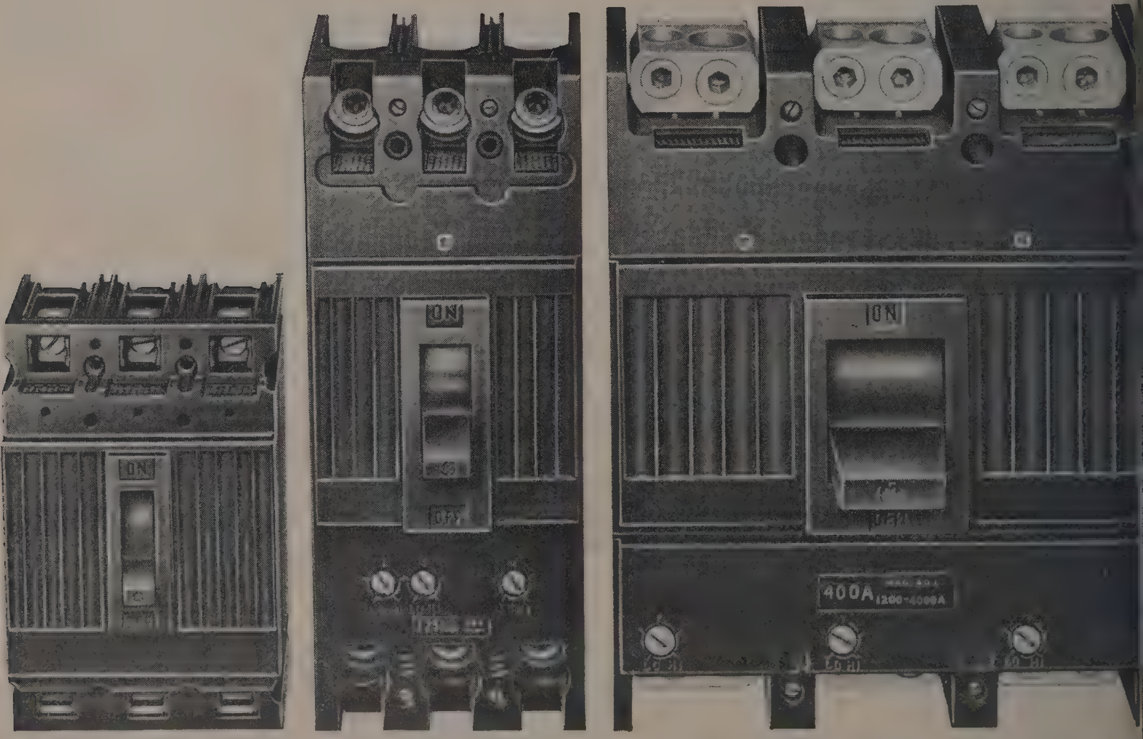
lighting
KLIEGL BROS.
UNIVERSAL ELECTRIC STAGE LIGHTING CO., INC.
321 W. 50th ST., NEW YORK 19, N. Y.
ORIGINATORS AND MANUFACTURERS OF KLIEGLIGHTS

NEW

simple to selec

15 to 1000 amperes

in just four frame size



E-100
15 to 100 amperes
240, 480 volts

F-225
70 to 225 amperes
240, 480, 600 volts

J-400
125 to 400 amperes
240, 480, 600 volts

Double-barreled versatility! Featured on new F-225 and J-400 lines: interchangeable trip models within each frame size permit change of rating even after breaker has been installed. Also available, fixed trip models where lower first cost is prime consideration. With G-E you zero in on *specific* requirements!

and apply... General Electric Circuit Breakers

Available from stock now!

K-1000
125 to 1000 amperes
240, 480, 600 volts

Now only four basic frame sizes cover every need from 15 to 1000 amperes. No more guessing games, no more confusion — selecting a circuit breaker from the G-E line is as easy as this . . .

E 100 LINE	15-100 Amp	J 400 LINE	125-400 Amp
F 225 LINE	70-225 Amp	K 1000 LINE	125-1000 Amp

This break-through in convenience is made possible by the new F-225 and J-400 breaker lines, which offer outstanding advantages like these . . .

- **Ambient Compensation** — A standard feature. Permits installation in ambients up to 50 C without complex derating.
- **Front Adjustable Magnetic Trip** — Provides ± 10% accuracy at *all* settings, not just high or low.
- **Dual lugs** — Suitable for copper or aluminum wire.
- **Space saving up to 70 percent** over equivalent old styles.

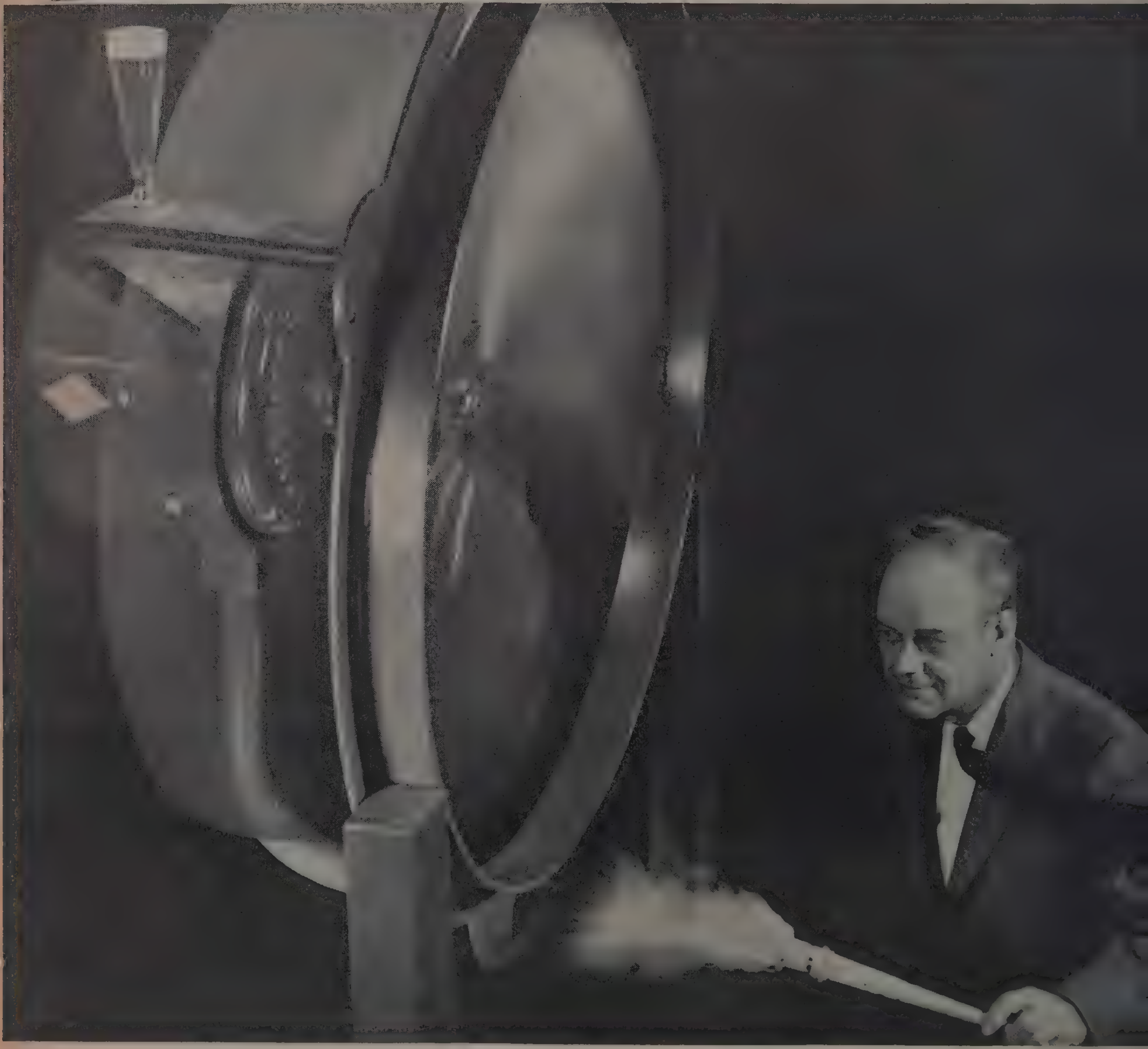
Other features: field and factory installed accessories; NEMA 1, 1A, 3R, 4 and 5 enclosures; Hi-Break* 75 models (75,000 ampere I.C.) Vu-Break* Models (visible contacts); and magnetic-trip-only breakers for special requirements.

Easy to select, versatile, compact — all good reasons to specify General Electric circuit breakers for your next installation.

* Trade Mark of General Electric Company

GENERAL ELECTRIC

Name Your Choice. For every propeller fan need, Ilg has the answer. Shown here: (left) Ilg Type PF squar panel fans with direct-connected, self-cooled motor; (cen- ter) Ilg Type TAQ direct-connected tubeaxial duct fans; (right) Ilg Type XQ direct-connected, explosion-proo models for hazardous applications.



HERE'S WHY ILG FANS RUN COOL AND QUIET

See how the vent pipe on this Ilg propeller fan sucks in outside air . . . pressure-cools the permanently lubricated, direct-connected Ilg motor. Ilg's famous self-cooling feature provides the protection of motor enclosure, the operating economy of open types, and keeps motors clean *inside and out.*

And with dynamic balancing of all component parts . . . elec- tronic checking of Ilg motors and wheels before and afte assembly . . . you can be sure Ilg self-cooled fans run so quiet- ly, so smoothly you can balance a glass of beer on the motor, *while the fan runs,* and find no bubbles due to vibration. For further information, write for Bulletin DB1-100.

ILG

ILG ELECTRIC VENTILATING CO

2879 N. Pulaski Road, Chicago 41, Ill.
Offices in 60 Principal Cities
Member of Air Moving and Conditioning Association, Inc. (AMCA)

OR MORE INFORMATION ON

NEW PRODUCTS
CATALOGS, BULLETINS
ADVERTISEMENTS

USE THESE CARDS ➧

RODUCT NEWS, PRODUCT BRIEFS:

Use first line of boxes. Insert item numbers of products on which more information is desired.

**ATALOGS, BULLETINS AND ENGINEER-
NG DATA:**

Use second line of boxes. Insert item numbers of literature desired.

DVERTISEMENTS:

Use third line of boxes. Insert page numbers of advertisements on which additional information is desired. Where more than one advertisement appears on the page, include the manufacturer's initials.

PORTANT...

PLEASE PRINT LEGIBLY

USE BLACK OR DARK BLUE INK

DO NOT USE PENCIL OR RUBBER STAMP

***Your Name** and address will be reproduced and sent to the appropriate manufacturers. Illegible or incomplete addresses may result in your not receiving the information you desire.*

Read your own personal copy.

et the latest time and money-
ving methods for

- estimating
- wiring
- maintenance

ery month in

ELECTRICAL
RUCTION and MAINTENANCE

**Fill in this card
and mail it TODAY!**

NEW SUBSCRIPTION APPLICATION CARD

YES SIR! I want to know the latest electrical estimating, wiring and maintenance methods! Enter my subscription to ELECTRICAL CONSTRUCTION & MAINTENANCE for a full year's service (13 helpful issues) for only $3.*

☐ Check here for two years at $4* (You save $2)

(* United States only. Canadian and overseas rates on request.)

Please print—and fill out completely

NAME .... TITLE OR POSITION..................................

ADDRESS ☐ Home ☐ Business..

CITY..................................ZONE...........STATE..............................

CO. NAME..

OUR MAIN BUSINESS IS..

I am in charge of Electric Work ☐YES ☐ NO

Operate a Motor Service Shop? ☐ YES ☐ NO

Person in charge of Elec. Work is..................................

Please do not write in this box.
EC-
U-

EC-RS-11/6

Send No Money Now—Simply Mail Card Today!

FOR MORE INFORMATION O

NEW PRODUCTS
CATALOGS, BULLETINS
ADVERTISEMENTS

USE THESE CARDS

- **PRODUCT NEWS, PRODUCT BRIEFS:**

  Use first line of boxes. Insert item numb of products on which more information desired.

- **CATALOGS, BULLETINS AND ENGINEE ING DATA:**

  Use second line of boxes. Insert item numb of literature desired.

- **ADVERTISEMENTS:**

  Use third line of boxes. Insert page numb of advertisements on which additional inf mation is desired. Where more than one vertisement appears on the page, include manufacturer's initials.

Your Name and address will be reproduced and sent to the appropriate manufacturers. Illegible or incomplete addresses may result in your not receiving the information you desire.

IMPORTANT...

- PLEASE PRINT LEGIBLY
- USE BLACK OR DARK BLUE INK
- DO NOT USE PENCIL OR RUBBER STAM

FIRST CLASS
PERMIT No. 64
NEW YORK, N. Y.

BUSINESS REPLY MAIL
No Postage Stamp Necessary If Mailed In The United States

POSTAGE WILL BE PAID BY

McGRAW-HILL PUBLISHING CO., Inc.

Electrical Construction & Maintenance
330 WEST 42nd STREET
NEW YORK 36, N. Y.

NOW

is the time to put

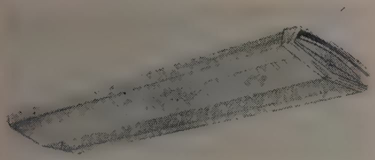
ELECTRICAL CONSTRUCTION and MAINTENANCE

to work for you!

Mail the attached card

TODAY

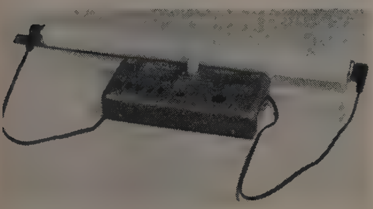
Product News



Lighting Unit (1)

A new low silhouette, fluorescent light M-4812, is designed for low ceilings, for kitchen, work and recreation areas and is 3½ in. in height. Features include one-piece construction with snap end caps; white plastic sides and prismatic lens. Width 11½ in.; length 50 in. overall. It uses two 4-watt rapid-start tubes.

Moe Light Division, Thomas Industries, Inc., 207 *East Broadway, Louisville* 2, *Ky.*



Lamp Tester (2)

New lamp testing equipment provides a quick method of testing fluorescent and incandescent lamps and fluorescent starters. It will test fluorescent pre-heat, rapid-start and circline lamps as well as fluorescent starters FS-2 for 14-, 15- and 20-watt lamps; FS-12 for 32-watt circline lamps; FS-25 for 25-watt lamps; FS-4 for 30- and 40-watt lamps and no-blink starters. Incandescent lamp testing equipment is designed to handle all multiple filament lamps, 2- and 3-way, as well as single-filament lamps. Adjustable clips permit many various types of installation. Literature is available.

Mitchell Lighting Div., Compco Corp., 1800 *N. Spaulding Ave., Chicago* 47, *Ill.*

Door Chimes (3)

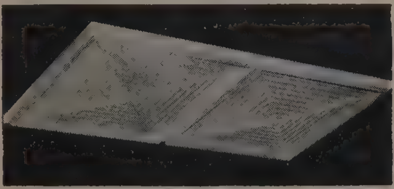
Four new residential door chimes, Models C-11, C-82, C-85 and C-104, have been introduced. The new entrance signals have been designed for long life and flexible installation. Resilient plunger tips, fabricated from a special plastic material, is a feature. Chimes use one-piece nylon coil bobbins. Large wiring terminals and ⅜-in. wire entrance holes ease installation. Model C-11 is suitable for tract home installation. Model C-82, the Clef, a flush-mounting chime, can be installed in a variety of ways: to a saddle, bridge, wall stud, or to sheet rock in either new construction or remodeling. Brackets can be side and/or top-bottom mounted. Model C-85, Golden Bolero III chime, contains patented vibrachord movement. Model C-104 offers a two-note signal for a single entrance.

Edwards Company, Inc., Norwalk, Conn.

Drive (4)

A new 6-speed Selectro-Shift drive with remote control panel is available in 20, 25, 30 and 40 hp. Hydraulic clutches activated by electric solenoids shift the drive to any of six speeds while running under full load. Shifting is controlled by an electric pushbutton station which can be installed any required distance from the drive. Unit can be operated in either reverse or forward position in all six speeds.

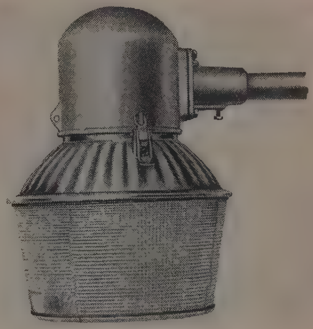
Lima Electric Motor Co., Inc., Lima, Ohio



Lighting Fixture (5)

A new modular lighting fixture with twin prismatic lenses for use in offices, stores, libraries, banks, drafting rooms, schools, hospitals, motels and similar places. The "6600" is a surface-mounted unit measuring nominally 4 by 2 ft wide. It houses four fluorescent lamps, and its two acrylic plastic lenses are each 2 ft square. Fixtures are joined mechanically and electrically end-to-end, side-by-side, or end-to-side to form rows, squares, or L's for small, medium, large and odd-shaped rooms. Fixture is $1\frac{5}{16}$-in. deep at edges and pyramid-shaped lenses taper downward to apexes $3\frac{3}{16}$ in. below ceiling level.

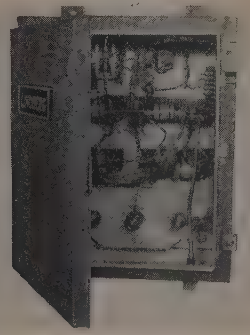
Holophane Company, Inc., 342 *Madison Ave., New York* 17, *N. Y.*



Roadway Luminaire (6)

A new luminaire, called Quadroliner, controls the lighting pattern on urban and rural roads. An open-bottom refractor is composed of four individual quadrants or sections. Each section is available in five different designs. It can be relamped and cleaned without unlatching or removing reflector assembly. Luminaire can use incandescent or mercury lamps up to 250 watts. Photocontrol is available with luminaire to operate the unit automatically.

Westinghouse Electric Corp., Lighting Div., Edgewater Park, Cleveland, Ohio

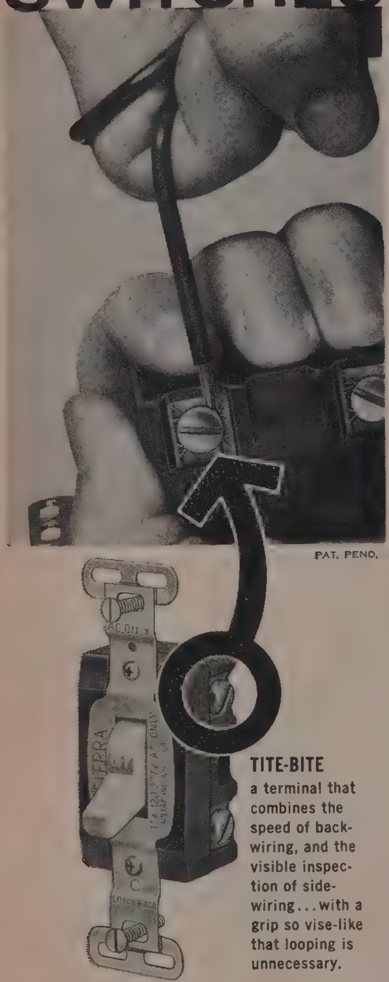


Rectifier Power Control (7)

A 70-kw silicon-controlled rectifier power control has been announced. Unit provides stepless control of power from zero level to a full 70 kw and power output is controlled automatically or remotely by milliwatt dc signal. All components are designed and installed for easy access and, while many uses are possible, precise control is used with proportioning systems. It has an input of 230 or 460 volts, water-cooled, and adaptable for either sub-panel or wall mounting.

Lindberg Engineering Co., 2450 *West Hubbard St., Chicago* 12, *Ill.*

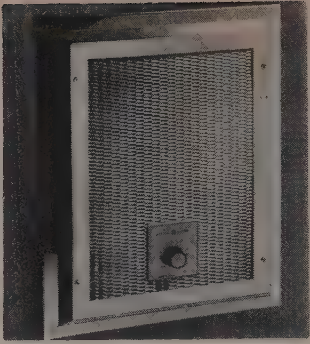
NEW
SIERRA
Q-T
SWITCHES



TITE-BITE
a terminal that combines the speed of back-wiring, and the visible inspection of side-wiring...with a grip so vise-like that looping is unnecessary.

SIERRA "Q-T" is the new quiet-type switch that can pass your most critical inspection. The "Q-T" is UL approved, meets all codes and standards. Moreover "Q-T" meets or exceeds all of the specifications normally applied to switches priced considerably higher.

SIERRA ELECTRIC
CORPORATION
15100 SOUTH FIGUEROA STREET
BOX 85, GARDENA, CALIFORNIA
Write for more information and catalog



Electric Heater (8)

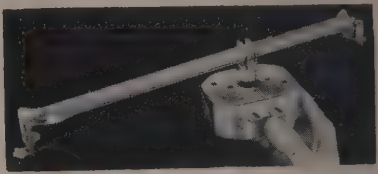
A wall-type, forced-convection electric heater is for use in bathrooms, dressing rooms, entry halls, or wherever complete or supplementary heating is required. Easily mounted on wall of new or existing construction without cutting into floors, carpets, or running additional ducts or pipes, the heaters are styled to match decor of modern interiors. Grille is chrome-plated. Covering mesh has such small openings that fingers and smaller objects cannot be pushed through to Calrod heating element. Control dial is a combination on-off and thermostat switch which selects and maintains room temperature at desired level. Heater is listed by UL.

General Electric Co., Electric Comfort Heating Section, Appliance Park, Louisville, Ky.

Pilot Light Kit (9)

A new kit for easy field installation of a pilot light to the Size 00 starter in a general purpose enclosure has been introduced. Available in three voltage ratings—110, 208/220 and 440/550 volts—the pilot light kits can be used on any frequency from 25 to 60 cycles. All general purpose enclosures for starters are furnished with a knockout in the cover. A 2-piece lens designed for maximum light diffusion is snapped into the knockout. Socket and bulb assembly mounts conveniently to top coil terminal. Each kit contains the socket and resistor assembly, lens and lens cover, a neon bulb, power lead and complete mounting instructions.

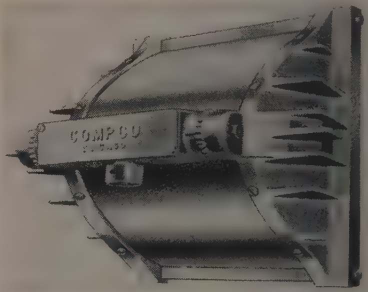
Square D Company, 4041 N. Richards St., Milwaukee 12, Wis.



Bar Hanger (10)

A new adjustable bar hanger, Efcor HA, which mounts outlet boxes without need for stud disassembly has been introduced. Unit is slipped over stud and a twist of a screwdriver secures box through cam action. Stud can be rotated on bar and secured in any position. An embossed length gage permits presetting to required length before installation. An additional gage assures correct height setting for various dry wall and plaster installations. Literature is available.

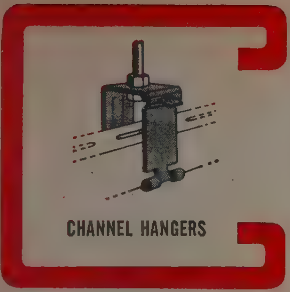
Electrical Fittings Corp., East Farmingdale, L. I., N. Y.

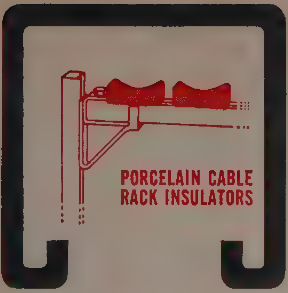


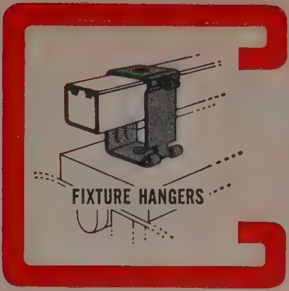
Lighting Fixture (11)

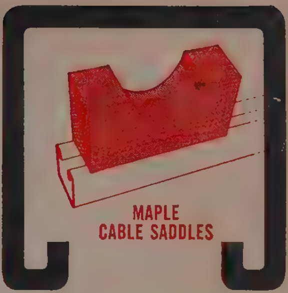
New PowerQuartz Series controlled beam lighting fixture is designed to fully harness and employ the new basic properties of the quartz-iodine filament lamp. It offers precision focused beam control and accent lighting. Choice of precision parabolic reflectors permits accurate and creative application of light-flux distribution to the requirements of the area to be illuminated. Mechanical features include case aluminum-alloy heat-dissipating fins, multi-connection splice box, fused sockets, tempered glass enclosure, heavy-duty gaskets, die-formed aluminum housing and cast aluminum-alloy ends. Literature is available.

Mitchell Lighting Div., Compco Corp., 1800 N. Spaulding Ave., Chicago 47, Ill.

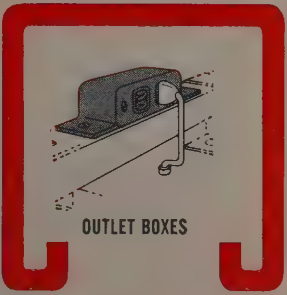

CHANNEL HANGERS

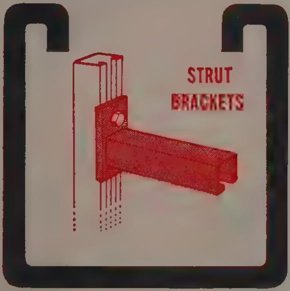

PORCELAIN CABLE RACK INSULATORS

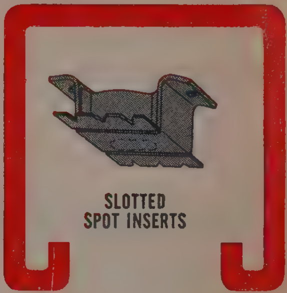

FIXTURE HANGERS

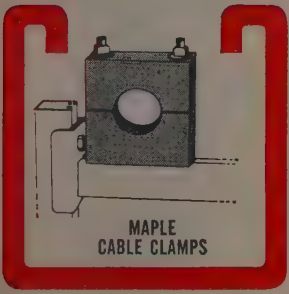

MAPLE CABLE SADDLES

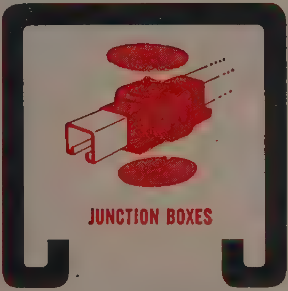
CONTINUOUS CONCRETE INSERTS

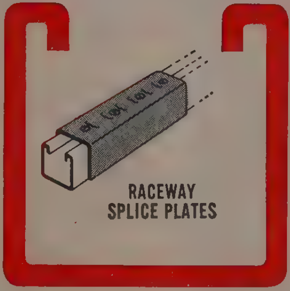

OUTLET BOXES


STRUT BRACKETS


SLOTTED SPOT INSERTS

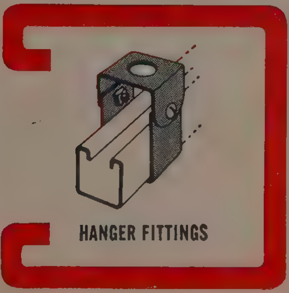

MAPLE CABLE CLAMPS

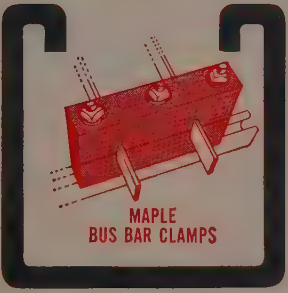

JUNCTION BOXES

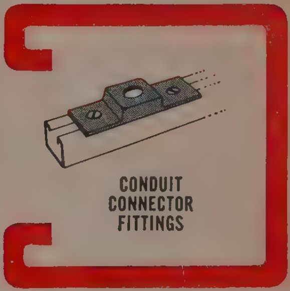

RACEWAY SPLICE PLATES

BEAM CLAMPS

CONDUIT CLAMPS


HANGER FITTINGS


MAPLE BUS BAR CLAMPS


CONDUIT CONNECTOR FITTINGS

WITH POWER-STRUT CHANNEL AND FITTINGS YOU CAN

HANG IT ALL

BETTER, FASTER AND AT LOW COST

The simplicity and flexibility of Power-Strut's wide range of continuous slot channel, proven Power-Grip nut and complete line of fittings will save you time and money. The free 24 page catalog shows you how. Write for it today.

HANG IT ALL HERE

POWER-STRUT DIVISION VAN HUFFEL TUBE CORPORATION • WARREN, OHIO

Be Sure with Field Tested

MINERALLAC®

NO. 100

COMPOUND

"PULL-IN"

Cuts Costly Minutes from Every "Pulling Job"

For Use on Rubber, Synthetic, Plastic or Lead Covered Wire and Cables

MINERALLAC
"PULL-IN"
COMPOUND
NO. 100
FOR RUBBER, SYNTHETIC, PLASTIC OR LEAD COVERED WIRES OR CABLES
MINERALLAC Electric COMPANY

AVAILABLE IN PINT, QUART, ½ GALLON, GALLON, 5 GALLON CONTAINERS AND 50 GALLON DRUMS

Minerallac "Pull-in" Compound No. 100, approved by Underwriters' Laboratories, was especially developed to cut costs and speed up electrical installations. It lubricates thoroughly, thus reducing tensions on hard pulls and facilitating easy pulling of wires and cables into conduits.

You can be sure of Minerallac Compound No. 100 . . . it has been field tested for years. Here are a few exclusive features of Compound No. 100:

- Non-injurious to wire or cable!
- Non-injurious to skin . . . non-toxic!
- Contains no petroleum products!
- High in lubricating value!
- Easily applied by hand!
- No offensive odors!
- Will not dry out or disintegrate in the can!
- Will not run, drip or stain!

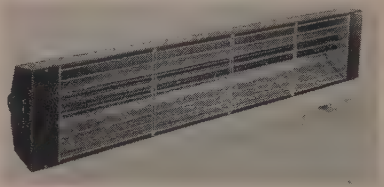
Order from Your Electrical Wholesaler
LITERATURE OR SAMPLE ON REQUEST

MINERALLAC *Electric* COMPANY
ESTABLISHED 1894
25 N PEORIA STREET • CHICAGO 7, ILLINOIS

Circuit Breakers (12)

A complete new line of molded case circuit breakers for industrial use, designated Type QCC. Breakers are available in current ratings of 125, 150, 175 and 200 amps in any of four pole and voltage combinations: 1-pole 120/240 volts ac; 2-pole 120/240 volts ac; 2-pole 240 volts ac; and 3-pole 240 volts ac. Interrupting rating is 10,000 amps. Common trip is available on 240-volt multiple-pole units. All units are 7 in. high and $2\frac{11}{16}$ in. deep. The single-pole is $1\frac{1}{2}$ in. wide; 2-pole units are 3 in. wide; and 3-pole is $4\frac{1}{2}$ in. wide. Type QCC breakers are designed for circuit protection on industrial low-voltage distribution systems and are especially suitable for service-entrance application.

Westinghouse Electric Corp., Standard Control Div., Beaver, Pa.



Radiant Tube Heaters (13)

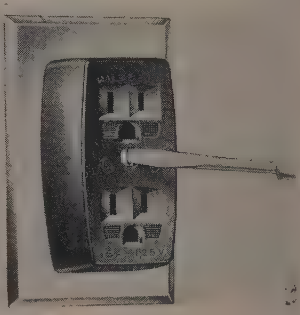
An improved design TD series industrial and commercial type radiant tube heaters have been announced. They are available in 1500-, 2000-, 2500- and 3000-watt models, all for 240-volt service. Units are listed by UL. They are especially adaptable to heating work areas in factories, shops, offices, loading docks and for general supplementary heating purposes.

Sun-Heat, Inc., Electric Heat Division of Insto-Gas Corp., 998 *E. Woodbridge Ave., Detroit* 7, *Mich.*

Tool (14)

A new abrasive cut-off saw is known as the Mercury Junior model dry electric saw. It is mounted on a rigid aluminum base and pedestal casting. Top table unit pivots to allow chop-stroke cutting. Cut-off wheel is guarded and provided with a special spark deflector. Saw is hand operated on standard models with foot pedal operation available as optional equipment. The 16-in. diameter wheel capacity and special 2750 rpm arbor shaft speed provide fast cutting action and accommodate 4-in. tubing or 2-in. solid material.

Obear & Sons, Inc., 940 *West Florence Ave., Inglewood* 1, *Calif.*



Adapter (15)

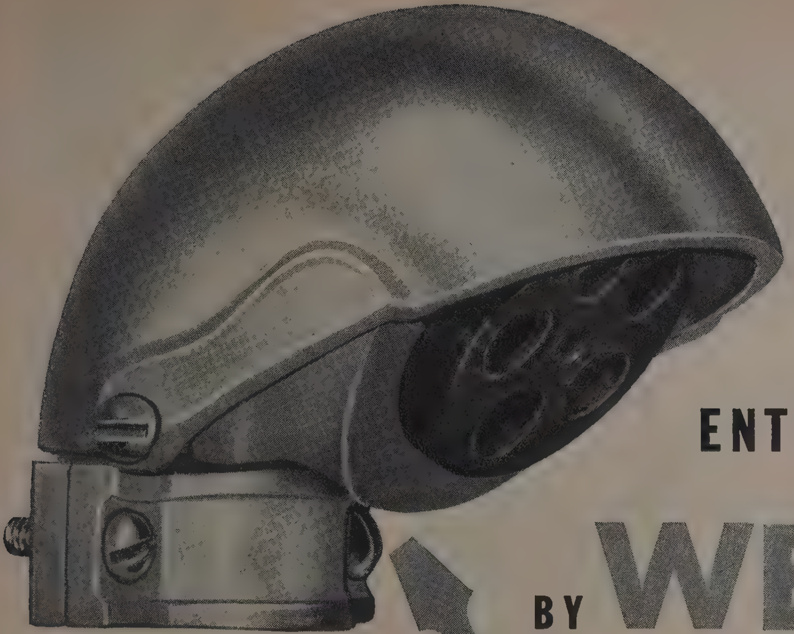
New plug-in adapter provides temporary conversion to 3-wire electrical grounding receptacles. With this device, existing wall receptacles remain in place. To convert, nothing in the existing system needs to be changed except the screws holding the metal or plastic cover plate on the wall. When these screws are removed, the plate remains in place and the new adapter is plugged into the receptacle. Then the adapter screw is threaded into place. Where an existing wiring system is not grounded, a special green grounding screw on the adapter can be connected to a wire running to a water pipe or other suitable ground connection. Adapter is designed to plug into any standard parallel or T-slot 15-amp, 125-volt duplex receptacle. It is UL listed.

Harvey Hubbell Company, Bridgeport, Conn.

Fluorescent Fixture (16)

The Power-V Series is a complete line of RLM industrial fluorescent lighting fixtures. All models producing both 10% and 25% nominal "up-lighting" are designed for high efficiency and other lighting characteristics. Fixtures are adaptable to 430-ma rapid-start and instant-start lamps, 800-ma high-output rapid-start lamps, plus all types of 1500-ma extra-high-output rapid-start lamps.

Sylvania Lighting Fixtures, Wheeling, W. Va.



THE ORIGINAL DUAL-GRIP ENTRANCE HEADS*

BY WEAVER

LOOK FOR THE PATENT NUMBER—
YOUR PROTECTION AGAINST COPIES!
*U. S. PAT. NO. 2,739,999

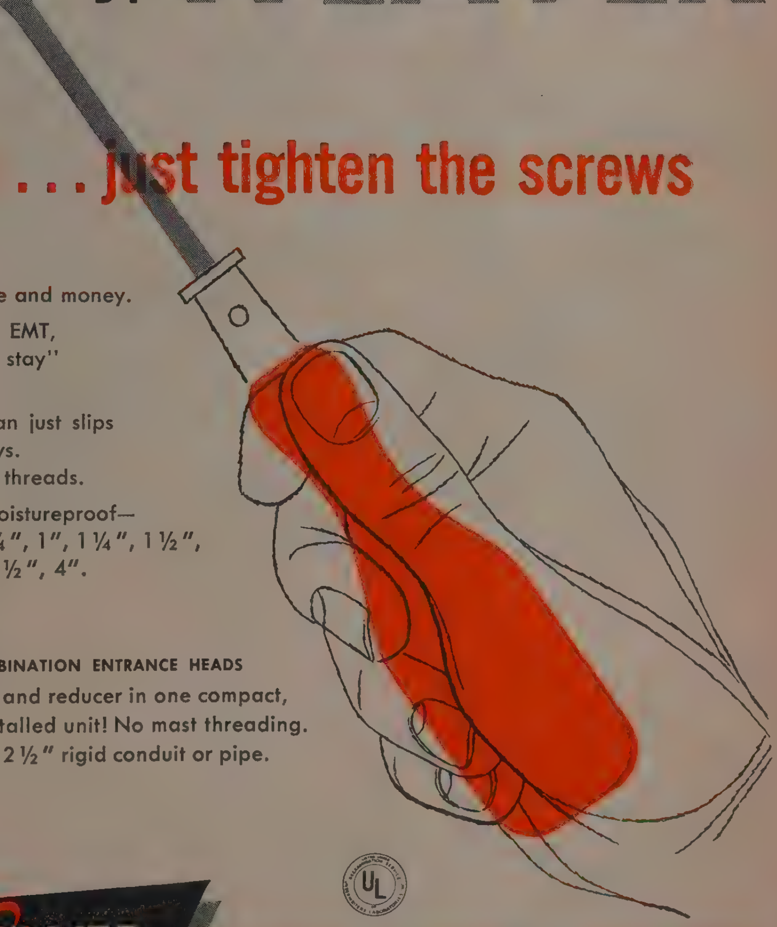
easier to use . . . just tighten the screws

"Dual-Grips" save your customers time and money.

When "Dual-Grips" are used on EMT, your customers know they're "on to stay" —with no special fittings.

With rigid conduit, the electrician just slips the head on and tightens the screws. No valuable time wasted cutting threads.

Lightweight aluminum alloy—moistureproof—rustproof. Ten sizes: ½", ¾", 1", 1¼", 1½", 2", 2½", 3", 3½", 4".



NEW COMBINATION ENTRANCE HEADS

. . . head and reducer in one compact, easily installed unit! No mast threading. For 2" or 2½" rigid conduit or pipe.

J. A. WEAVER Company

2110 HOWARD ST., ST. LOUIS 6, MO.

telephone GA 1-6336

Instantaneous action on short circuits! Fuse links (A) at either end melt away instantly, causing heavier sections (B) to drop away.

Timed delay on overloads! Econ-Alloy element protects against overloads up to 500% of fuse rating, prevents unnecessary fuse blowing and machine downtime.

Quick, positive action on dangerous overloads! Econ-Alloy (A) changes instantly to liquid. Extra-wide gap (B) provides "safe-break" distance, prevents arcing.

it blows!

(but only when it's supposed to)

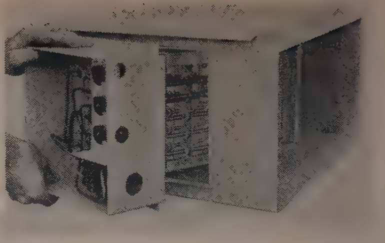
On a short circuit, an Econ® dual-element fuse blows instantly. However, on an overload it blows only when the pre-determined heat and time limits are reached—never too early, never too late! This unparalleled consistency is possible because the Econ fuse has an exclusive eutectic thermal-alloy element acting as a heat-sensing device.

Econ's eutectic alloy, laboratory controlled from production to utilization, operates on the heat created by the over-current. Result—more dependable operation, lower fuse replacement costs and reduced downtime on machinery.

What's more, ECON dual-element fuses are certified by Electrical Testing Laboratories, Inc., to interrupt in excess of 100,000 RMS amperes! ECON dual element fuses are another big reason why, when it comes to fused circuit protection, it pays to "Remember to Use Economy Fuse!"

FPE **ECONOMY FUSE DIVISION,** Des Plaines, Illinois
FEDERAL PACIFIC ELECTRIC COMPANY

FREE! Complete 12-page fuse catalog and pocket-sized fuse selector for motor protection.



Duct Heaters **(17)**

A new line of electric duct heaters for universal application has been introduced. They are designed for use as supplemental heaters in heat pumps, as air heaters in ventilating systems, or in conjunction with straight air conditioning units. They are available in 6-, 8- and 12-kw units for single- or 3-phase 240-volt service; 208-volt or 480-volt elements are available on special order. Each duct heater includes a main contactor, a combination automatic reset limit and duct control, a low-voltage terminal strip, and a plate-mounted control voltage transformer. Provisions are made for multiple staging by installation of up to two additional ductstats. They are listed by UL.

Thermador Electrical Manufacturing Co., 5119 *District Blvd., Los Angeles* 22, *Calif.*

Ventilator **(18)**

A new fallout shelter ventilator, called the Shelt-A-Vent, has been developed. It can be operated either by hand or through a motor connected to any regular 110-volt circuit. When electricity is available, it can be connected to an automatic timer for periodic air moving. Mounted on a galvanized steel base with a clamp, the ventilator can be mounted on a table, sill, ledge or beam. Standard 6-in. diameter ductwork is connected to the ventilator's side and run to outside of the shelter for fresh air intake.

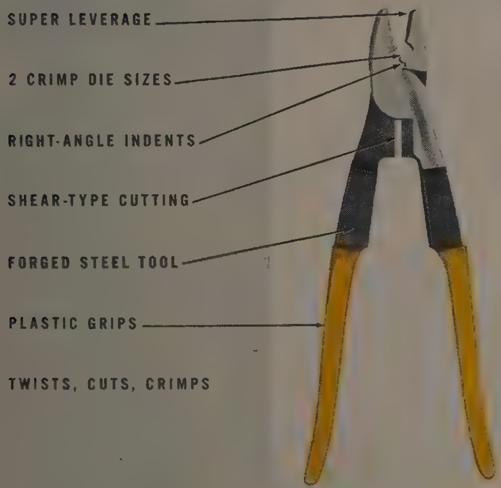
Lau Blower Co., 2027 *Home Ave., Dayton* 7, *Ohio*

LOOK FOR THIS DISPLAY AT YOUR ELECTRICAL DISTRIBUTOR

IDEAL

new crimp tool FREE

WITH PURCHASE OF SPECIAL WRAP-CAP® WIRE CONNECTOR PACKAGE



special offer!

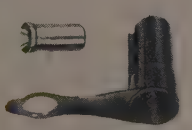
New Crimp Tool	$\$4^{25}$
50 Large Connectors	3^{03}
300 Small Connectors ..	8^{25}
VALUE	$\$15^{53}$

you pay only...$\$11^{28}$

CRIMP and WRAP-CAP NOW IN 2 SIZES . . . LARGE and SMALL

ORIGINAL STEEL SLEEVE . . .

. . . WRAP-CAP THE UNIQUE "DIAPER-WRAP" UL CSA



Splices from one #18 with one #14 up to two #10 with two #14.

Splices from one #14 with one #16 up to one #6 with two #8.

Offer expires December 31, 1961

IDEAL INDUSTRIES, Inc. • Sycamore, Illinois

New from Westinghouse

QCC
200 amp
breakers
½ cost
½ size
½ weight
of conventional
breakers

From Westinghouse comes a complete new line of circuit breakers designated type QCC which are just ½ the cost, size and weight of conventional 200-amp breakers. They are designed for service entrance use up to 240 volts a.c. and 10,000 amps maximum interrupting capacity rating.

Although economically priced, Westinghouse QCC Breakers include the quality features of De-Ion arc quenchers, a quick-make, quick-break over center toggle mechanism, and thermal magnetic trips.

For more information contact your Westinghouse representative, Westinghouse distributor, nearest independent panelboard-switchboard builder, or write Westinghouse Electric Corporation, Standard Control Division, Beaver, Pa. *You can be sure . . . if it's Westinghouse.*

1 POLE
120/240v.

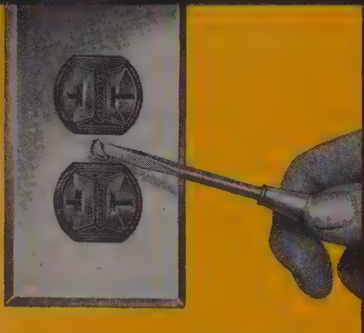
2 POLE
120/240v.

2 POLE
240v.

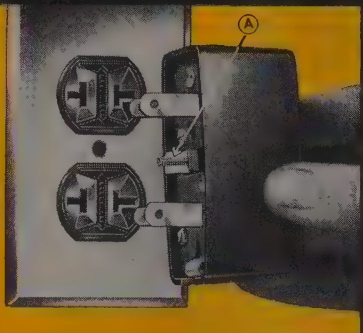
3 POLE
240v.

Westinghouse

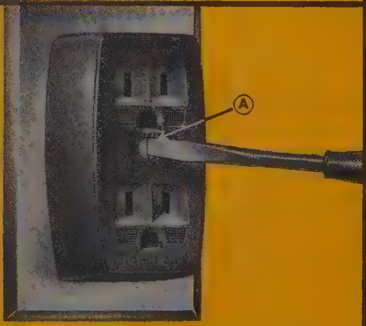
HUBBELL DUPLEX ADAPTER
15 A., 125 V.



Hubbell Duplex Adapter No. 5291 is easy to attach. Just remove screw holding metal or plastic plate to 2-wire receptacle. Leave plate in place.



Adapter plugs into 2-wire receptacle. Screw A will go through plate to grounded box. It is connected to both U-slots of adapter.



Tightening Screw A establishes adapter ground in a grounded system. If the system is ungrounded, connect adapter as shown at right.

When an existing system is not properly grounded, the adapter may be grounded by connecting a grounded wire to green hex Screw B.

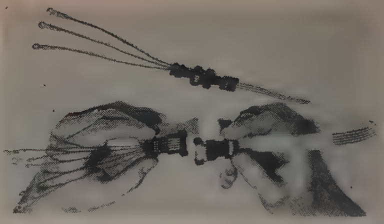
FAST TEMPORARY CONVERSION TO 3-WIRE GROUNDING SAFETY

This polarized, plug-in adapter converts 2-wire duplex receptacles used with grounded or ungrounded systems to temporary 3-wire grounding receptacles. Landlords find it a great convenience when tenants requiring 3-wire facilities cannot postpone occupancy until rewiring is completed.

To make a conversion, nothing in the existing system has to be removed except receptacle cover-plate screws, to make room for a captive screw in each adapter. This captive screw acts as a conductor from the two U-slots to the grounded system. For use with receptacles in ungrounded systems, there is a green binding screw to permit connection of an independent ground wire. Either way, the electrically independent blades and contacts continue existing split circuits.

The polarized adapter operates in any parallel or T-slot duplex receptacle with metal or plastic cover plates. Brown or ivorine bakelite, for 15 amperes, 125 volts. Size: 1.4″ from plate, 3.3″ high, 1.75″ wide.

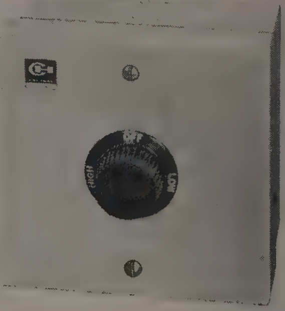
HARVEY HUBBELL INCORPORATED
Bridgeport 2, Connecticut



Adapter (19)

An adapter device for interconnecting flat conductor cable with conventional round wire has been introduced. This round wire adapter simplifies the introduction of the new flat cable to existing electrical and electronic equipment wiring systems. It is used to terminate flat cable runs at conventional terminal boards or strips, and facilitates flat cable runs under rugs, tile, in chassis, along walls where the ultimate termination is to round wire. New connector makes use of flat conductor cable a practical reality for low-voltage control wiring, intercom systems and remote control wiring. Bulletin P3-57 is available.

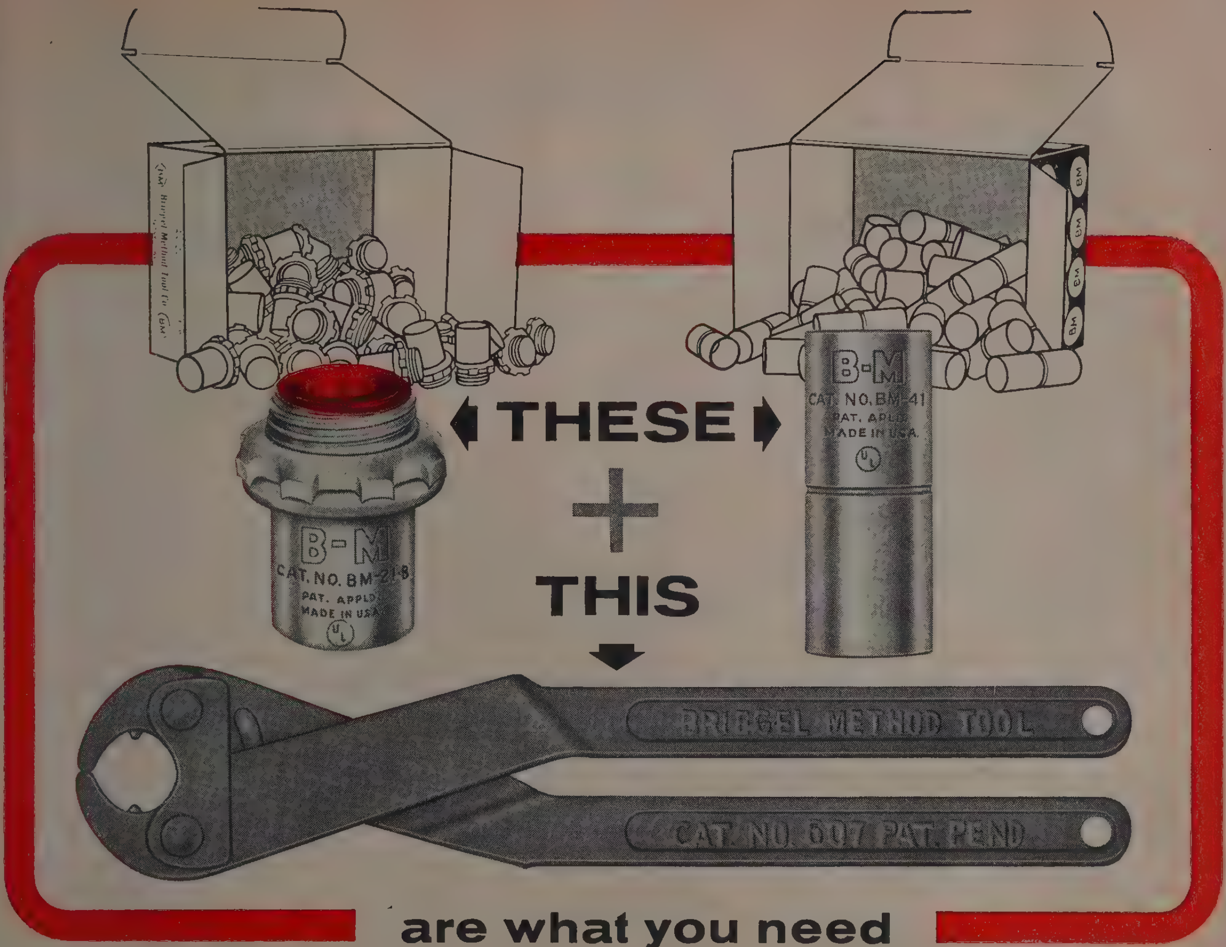
Thomas & Betts Co., 36 Butler St., Elizabeth, N. J.



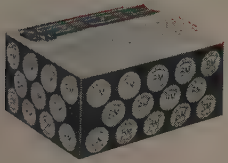
Starter (20)

Requirements of overload protection for both speeds on single-phase 2-speed motors are met by new ac 2-speed fractional hp manual starter. Device was developed in response to recent changes in electrical code requirements which no longer permit use of a single heater coil to protect both speeds of a 2-speed fan. This 4-in.-sq, 2-speed motor switch features a single, rotating operating knob with a clearly marked "High-Off-Low" legend for speed selection and "Reset" after overload. Unit is supplied with four types of mounting—NEMA 1 surface, flush panel, machine cavity, and plaster cover mounting in a standard 4-in.-sq box. It is available with or without pilot lights.

Cutler-Hammer, 315 North 12th St., Milwaukee 1, Wis.



are what you need to do the job Easier... Faster...Better and get more profits too!



● Here is the combination that is unbeatable when it comes to easier E. M. T. installation at less cost. New lightweight plier size indenters make setting up thin wall conduit a breeze. B-M fittings are neater too! No unsightly nuts or projecting set screws. B-M, the Original Indenter Fittings used with B-M Indenter tools, give you the best, most permanent ½", ¾" and 1" E. M. T. installations possible.

A few more of the plus features of B-M fittings are Concrete tight—Vibration resistant—Extra heavy bright zinc plate, salt spray and acid drip tested for corrosion resistance—Extra heavy positive bonding locknuts—smooth rounded edges or bushed throat type connectors that prevent insulation damage—All steel construction with extra heavy gauge wall thickness.

BRIEGEL METHOD TOOL CO.

GALVA, ILLINOIS

All B-M indenter type fittings far exceed the requirements of U. L. file card E 10863 and Federal Specifications W-F-406.

TELESCOPE BM SYSTEM

USED THE MOST FROM COAST TO COAST

No. 100. SP, 15 amp. 125-250V., 1 HP 120-240V. AC, normally off momentary contact switch. 1 amp. 125V., ½ amp. 250V. DC.

No. 71. SP, single circuit, lever switch . . . the thinnest 6 amp. "T" 125V—3 amp. 250V switch of its kind—only 15/32″ thick.

No. 90. ¾ HP capacity, 15 amp. 125V., 10 amp. 250V. toggle switch. SPST. Designed for AC operation. Also rated 20 amps. 125V AC non-inductive load. Choice of terminals. Also available in double-pole models.

McGILL INDUSTRY PROVED
QUALITY SAVES MAINTENANCE COSTS

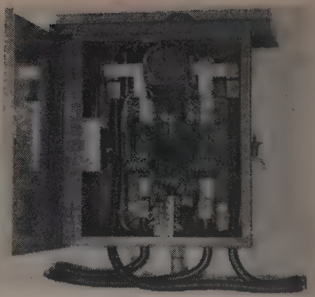
McGill lamp guards are built to withstand rugged industrial service. Top quality assures a safe, dependable light. Over 100 different types available, including grounded, vaporproof and a variety of types of cages, handles and sizes. Most models available with "safety yellow" handles and cord.
Use McGill lamp changers for fast, safe replacement of burned out or broken lamps.

Available from your Electrical Wholesaler

Write for McGill Electrical Specialties Catalog No. 84

engineered electrical products
McGILL
precision needle roller bearings

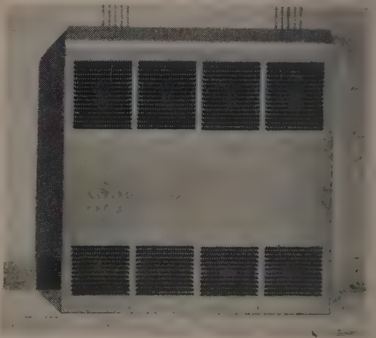
McGill Manufacturing Co., Inc., Electrical Div., 450 N. Campbell St., Valparaiso, Indiana



Switch (21)

A new pole-top metering switch has been developed. Designated the Meter-Rite, it features permanent means to increase customer service or to install new service up to 400 amps; cold load pick-up protection; transformer protection from overload and short circuits; permits old meter to be used when increasing customer power service. Switch is mounted at top of meter pole. Control breaker is mounted permanently directly below meter permitting customer to disconnect service if necessary. A thermal time-delay switch, mounted in weather-tight assembly box protects electrical system during power outages or failure. Line transformer is protected by a built-in circuit breaker matching transformer rating.

System Analyzer Corp., Nokomis, Ill.

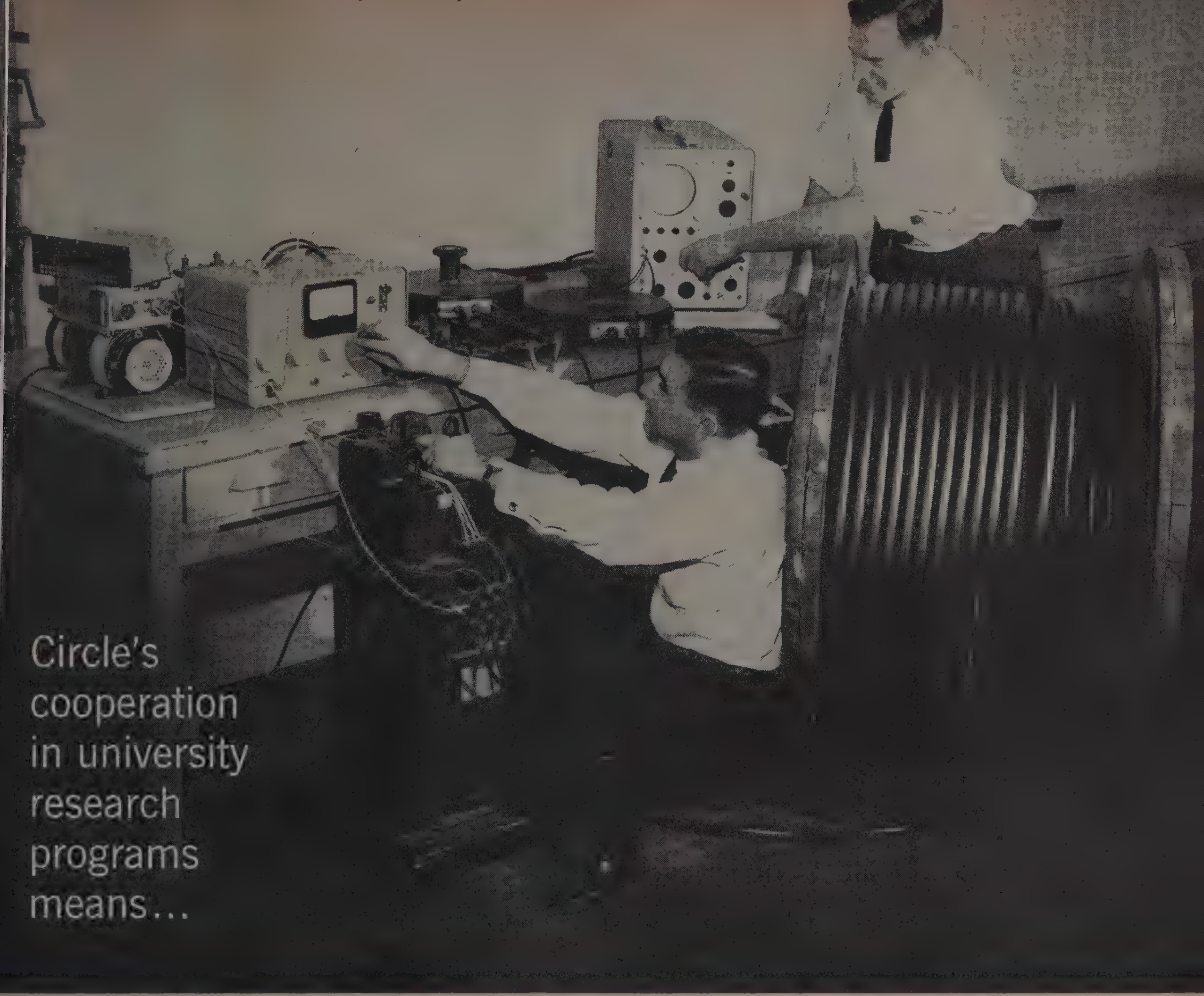


Heaters (22)

Cabinet styled convection heaters are made in 96 model combinations for commercial and residential use. Convector comes in two major types, surface mounted or slim recessed wall type. The recessed unit projects 2½ in. into the room. Models can be ordered with thermostat and relay, with relay only, with thermostat only, or without thermostat and relay. Available in 208-, 240- or 277-volt, single-phase with capacities of 1000, 2000, 3000 and 4000 watts.

Electromode, Division of Commercial Controls Corp., P. O. Box 1052, Rochester 3, N. Y.

run tests with Circle cable at University of Kentucky.



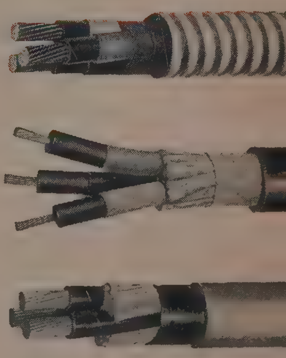
CABLE THAT MEETS TOMORROW'S NEEDS

Electrical engineering research programs being conducted in colleges and universities are vital to the continued progress of our industry.

Circle Wire & Cable is glad to cooperate fully with the universities to help assure the success of their projects. Circle has supplied reels of cable on a loan basis to a number of colleges engaged in the development of basic data on the behavior of cable under unusual conditions. At the University of Kentucky, for example, tests are being conducted, using Circle multiconductor cable, to develop basic data on skin effect and proximity effect on cable operated at 400 to 600 cps, 3 phase loading.

The results of these University of Kentucky tests and other basic research data developed in university laboratories contribute significantly to better cable design. This is the goal we continually strive for at Circle.

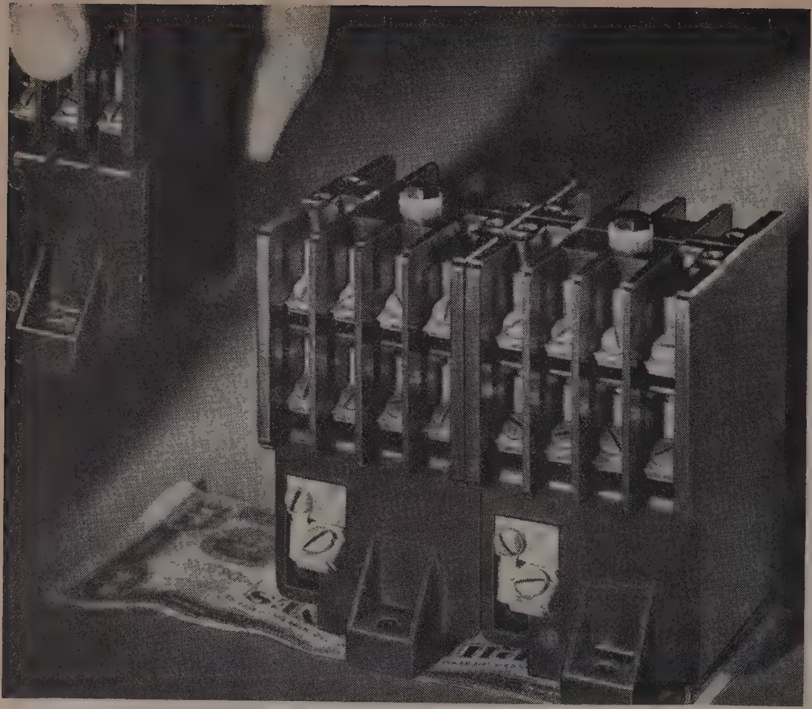
Specify Circle cable on your next job …there's no finer cable made.



CIRCLE WIRE & CABLE CORP.
SUBSIDIARY OF **CERRO CORPORATION**

PLANTS: Maspeth and Hicksville, N. Y. **SALES OFFICES & WAREHOUSES:** In all principal cities.

RUBBER COVERED WIRE & CABLE • VARNISHED CAMBRIC CABLE • PLASTIC INSULATED CABLE • NEOPRENE SHEATHED CABLE • CIRTUBE* EMT



Space savingest relay you've ever seen!

300 V. control relay so reliable it's permanently sealed

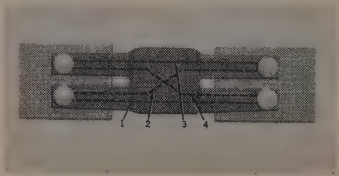
Here's the best answer yet to the need for an extremely reliable, compact 300 V. industrial relay—the new Cutler-Hammer "Compact 300"—up to 24 poles in an area less than a dollar bill in size.

This relay has proved so reliable we've permanently enclosed it. If it should be damaged by a fault current, it's priced so you can throw it away and replace. The "Compact 300's" low price makes this the practical, economical maintenance procedure.

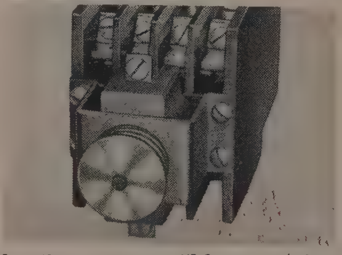
Think of the ways you can save needed space with this relay. Controls up to eight circuits in panel space only 2″ wide by 2¾″ high. 2, 3, 4, 6 and 8 poles with any combination of N.O. or N.C. contacts available.

There are many other exclusives in the "Compact 300" . . . call your local sales office for a demonstration. Or write for Pub. LO-79-X241.

WHAT'S NEW AT CUTLER-HAMMER? New and better products like the 300 V. relay are the order of the day at Cutler-Hammer this year. For helpful new ideas in all phases of electrical control planning, call on your Cutler-Hammer distributor or representative.



Greater contact reliability. Parallel bifurcated contacts allow 4 current paths instead of 1, provide much greater circuit reliability. Designed so any current path carries full rating.



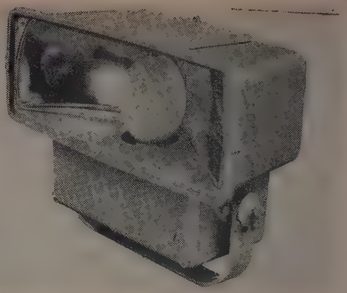
Another bonus. "Memory latch" as reliable as the relay itself. No adjustment ever needed . . . add latch at any time.

WHAT'S NEW? ASK...

CUTLER-HAMMER

CONTROL

Cutler-Hammer Inc., Milwaukee, Wisconsin • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C. A. • Associates: Cutler-Hammer Canada, Ltd.; Cutler-Hammer Mexicana, S. A.



Floodlights (23)

A powerpack-design mercury floodlight has been developed. The new internal-ballast units are available in two sizes—up to 400-watt in the smaller size, and 700-, 1000-, or 1500-watt in the larger size. A wrap-around reflector provides a wide beam for uniform coverage of wide rectangular areas. Features include a cast aluminum housing with separate aluminum reflector; weather-tight construction with heat-resisting gaskets; heavy galvanized-steel trunnion mounting with vertical degree markers and repositioning stop. Units are available with or without built-in powerpack ballasts. High-power-factor regulator ballasts are standard, but units may be ordered with low power factor lag, LPF and HPF reactor ballasts.

General Electric Co., Schenectady 5, N. Y.

Transformer Core & Coil (24)

The new DS-50 Bonus line of distribution transformers uses aluminum strip in the low-voltage winding and a new core design. Low-voltage windings are made with aluminum strip conductors the full width of the coil. Optimum magnetic balance between the two windings is obtained. The core employs a new and unique method of fabrication that develops a stress-free assembly in rectangular configuration.

H. K. Porter Co., Inc., Delta-Star Electric Div., 2437 Fulton St., Chicago 12, Ill.

Underfloor Duct (25)

A new large capacity standard underfloor duct is now available. The hot-dipped galvanized duct provides for a capacity of 3.9 sq in., with a depth of 1½ in. and a width of 3 in. The duct has standard 2-in. conduit thread outlets with a built-in conduit stop and is available in 1-in. through 3-in. heights, with greater extensions if required.

Wheatland Electric Products Co., Carnegie, Pa.

Make UNIFORM OFFSETS in 1/2" E.M.T. in 2 SECONDS

with NEW Greenlee No. 1810 "Little Kicker"

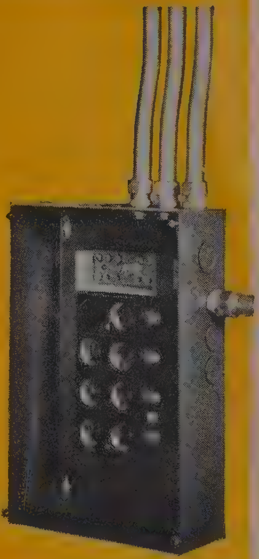
TOOLS FOR CRAFTSMEN
GREENLEE

FAST—makes complete offset in one shot

ACCURATE—every bend is identical

EASY—just press down on the handle

LIGHTWEIGHT—only 5-1/2 lb. Built of high-strength aluminum alloy and steel



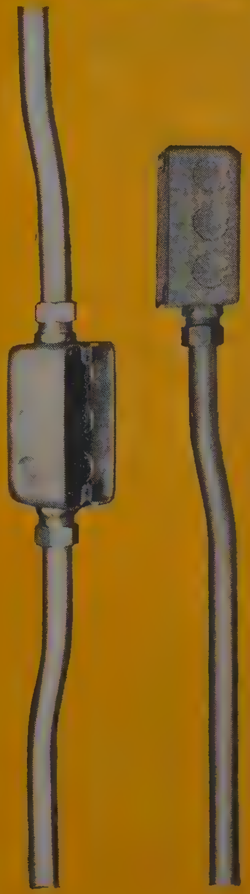
Here's the fastest and best way to form perfect offsets in ½" E.M.T. for entering switch boxes and other wall or ceiling outlets. Both bends of the offset are made simultaneously *in one shot*—easily and accurately. Eliminates hand bending with a hickey. Duplicate bends are exact, assuring a clean, tailored installation. No time is lost refitting or "cutting and trying."

Ask your Greenlee distributor for a demonstration soon!

GREENLEE TOOL CO.
1994 Columbia Ave.,
Rockford, Illinois

Another new addition to the Greenlee line of Job-Profit Tooling

SAVES TIME...DOES A BETTER JOB



NEW EXTRA VALUE FASTENER LINE

DIAMOND
BLUE-CUT
SELF-DRILLING ANCHORS

Exclusive
Lectro-Temp
Heat Treatment
Assures
"The Fits Plus the Grip"

KEYSTONE® EXPANSION SHIELDS
Exclusive Nutstop Prevents Nut Pullout.

DHD® HAMMER DRIVE ANCHORS
Exclusive Internal Ribs Provide Maximum Expansion.

DIAMOND-P-® LAG SCREW SHIELDS
Exclusive 4-Directional Expansion Fits Irregular Holes.

Red Seal® CALKING ANCHORS
Exclusive Red Fibre Disc Keeps Dirt Out of Threads.

wing-a-ding HOLLOW WALL ANCHORS
5 Times Greater Thread Area... No Stripping!

PLUS
More Than 500 Other Items With "Built-In" Extras
PLUS
Exclusive Pole Line Hardware

FREE SAMPLES
and Pocket Guide to Better Fastening
Send Request to
DIAMOND
DIAMOND EXPANSION BOLT CO., INC
[illegible] Avenue, Garwood, N. J.
Fasteners With Extra Value

Components (26)

Type "S" components are factory-installed in 2- and 4-circuit plug fuse blocks for 100- and 200-amp Add-On service equipment. These components cannot be removed by home owners and they permit insertion of 15-amp Type "S" fuses only, preventing overfusing of circuits and assuring compliance with code requirements wherever those requirements make this protection mandatory. Literature is available.

Arrow-Hart & Hegeman Electric Co., Hartford, Conn.

Tool (27)

A new tool called the Bend-a-drill is for outlet installation in drilling up through floors and cutting outlets. Insert it through outlet hole in wall and drill hole in floor to install new wiring.

BCI Industries, Unlimited, 8823 *Vans St., Paramount, Calif.*

Heat Panel (28)

T-E-C, an electric heat panel that puts a "comfort zone" around hospital windows by use of both radiant and convective heat, has been developed. It radiates 65% of its heat to create a warm area in which the patient may sit or stand in comfort, and by convection, 5% of its heat rises to form a curtain of warm air over the glass, preventing fogging, misting and frosting. T-E-C radiant heater panels can be thermostatically controlled either individually or collectively. This panel requires a

HOW TO DO AN OVERHEAD JOB Faster!

Saving time and making the job easier are the reasons for Baker Scaffolds wide-spread popularity. For instance, the Baker Scaffold with the Baker Hold-A-Load accessory shown makes the installation of lighting fixtures, conduit or other heavy or bulky items a one-man job.

Baker Scaffolds are extra useful any time. The easily adjusted work platform can be raised or lowered in 3-inch increments and the entire unit can be rolled through doorways and around sharp corners. There's no cross bracing underneath to prevent it rolling over obstructions that stop other scaffolds. Now, start saving money and speed up the job with Baker Scaffolds. See your local distributor for Baker Scaffolds or write direct to the factory.

Listed Under Re-examination Service Underwriters' Laboratories, Inc.

BAKER SCAFFOLDS
DESIGNED FOR PORTABILITY • BUILT FOR DURABILITY
BAKER-ROOS, INC.
P. O. Box 892, Dept. 613 Indianapolis 6, Ind.
DISTRIBUTORS IN PRINCIPAL CITIES

slight recess in the wall and one run of electrical conduit to carry the feed. Panel has a depth of $1\frac{5}{8}$ in., and can be integrated to the general heating system of the hospital room. The 400-watt 22- by 48-in. unit will deliver 1365 Btu/hr and the 800-watt 22 by 96 in. will produce 2730 Btu/hr. Listed by UL.

Electric Heating Div., Litecontrol Corp., Watertown, Mass.

Cooling Unit **(29)**

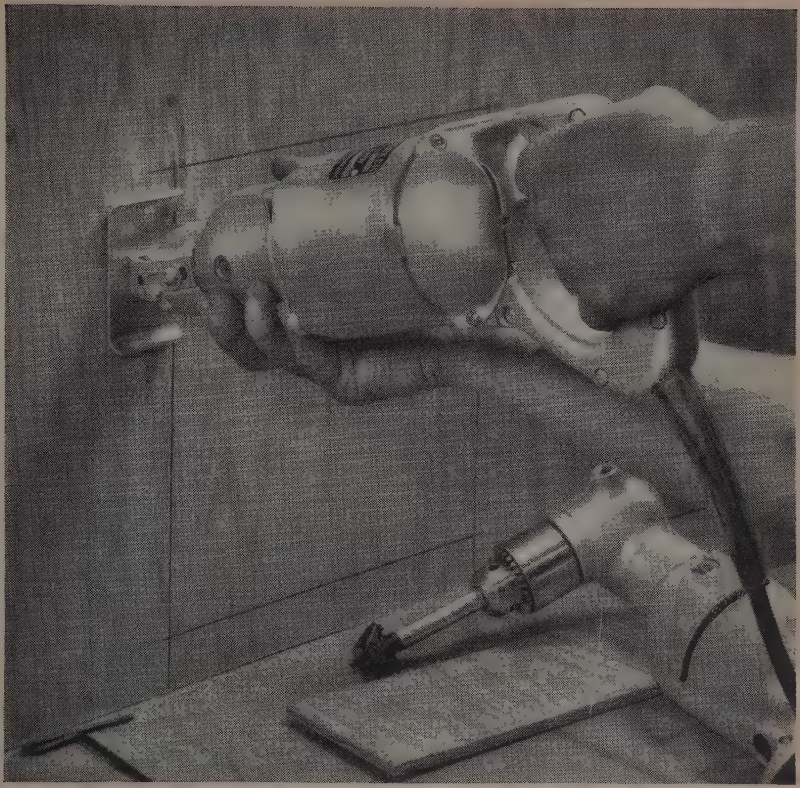
A new cooling unit for central air conditioning, which can be used either singly or in multiples for increased capacity, is now available. Known as the WhispAir air conditioner, Type UB-18A, it supplies 18,000 Btuh of cooling capacity. Blowers will deliver 600 cfm against a system resistance of 0.1 in. of water. Each unit will serve an area up to 1000 sq ft. For larger homes, two units may be used—each supplying different areas of the house. Unit is designed for mounting outside on any wall. Measuring about 6 ft high, 2 ft wide, and 1 ft deep, the cabinet of unit projects about the same distance from a wall as the overhang of an average roof. Outside panel of unit is removable, for maintenance.

Westinghouse Air Conditioning Div., Staunton, Va.

Lighting Fixture **(30)**

Recessed lighting fixture, called the Halo Wall-Wash Lite, rotates 360° to cast a soft light on "special interest" wall areas. Outer frame of unit remains stationary, and lamp reflectors rotate with inner frame. Light from a 150-watt general service lamp is emitted through a 1- by 4-in. aperture. Fixture is 8 in. wide and 9½ in. high over-all, with eggshell frame finish. Literature is available.

Halo Lighting Products, Inc., 4201 W. Grand Ave., Chicago 51, Ill.



CUT IT CLOSER

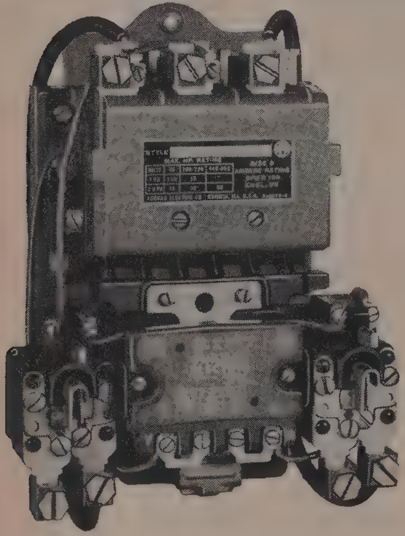
with Black & Decker Sabre Saw's off-set blade design

Cutting flush-to or around corners . . . B&D Sabre Saw gets closer with its unique off-set blade design. Three-way blade spindle turns 90° and 180° to cut out pockets, quicker . . . cut into corners, easier. Exclusive long-stroke action to go clean through everything, safeguard blade guide for up-front control, rock 'n' lock shoe design for steadiest handling . . . all assure solid sawing results.

Black & Decker®
CUTS MAN-HOURS TO MINUTES

Long-stroke action (1″ blade stroke) for faster work and longer blade life.

Adjustable blade spindle turns to cut right or left, backward or forward.



NEW

SIZE 3

1/3 SMALLER

The new compact Furnas Size 3 magnetic starters, 1/3 smaller than other Size 3 models, incorporate inherently trip-free melting alloy type thermal relays for greater motor protection, and a simplified, low wattage, electromagnet design. For 2, 3 and 4 pole, 30-50 hp.

- Features 1/3 more wiring room than other models.
- Contact assemblies readily accessible for routine inspection or servicing.
- Front removable parts.
- Mounting dimensions on open type identical to Sizes 2 and 2½.
- Pilot light, pushbutton, selector switch and third overload can be added in the field.

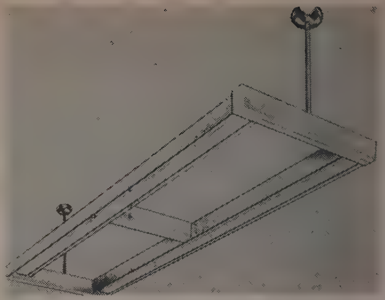
Write today for Bulletin 14-B3, 1067 McKee Street, Batavia, Illinois

A110

FURNAS ELECTRIC COMPANY • BATAVIA, ILLINOIS

Sales Representatives in All Principal Cities

FURNAS



Fluorescent Fixture (31)

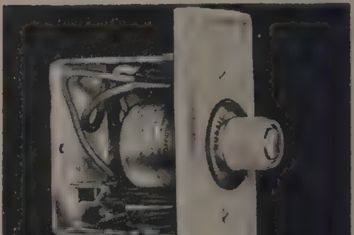
The semi-indirect HQ fluorescent fixture features 800-ma high output and 1500-ma very-high-output lamps. They are supplied with stems and canopies for pendant mounting approximately 18 in. below the ceiling. Shielding is available in 45° by 45° plastic louvers or diffuse polystyrene panels. Unit is for use in offices, engineering drafting rooms, schools, control centers, stores and many other commercial lighting applications.

Lighting Products Div., Sylvania Electric Products Inc., Box 831, Wheeling, W. Va.

Switch (32)

A new remote control Rocker-Glo switch features double-throw, center "off," momentary-contact action. Available in Despard, interchangeable type with wide rocker, and in strap type with narrow rocker for use in standard tumbler switch plates. Rated at 10 amps, 48 volts, ac, single pole, it is designed primarily for low-voltage remote-control use and recommended for controlling large banks of school, commercial and industrial lighting; for operating stage curtains, and related purposes.

Pass & Seymour, Inc., Solvay Station, Syracuse 9, N. Y.



Dimmer (33)

A new type of electric light dimmer, called "Hubbell-trol," operates both incandescent and rapid-start fluorescent lights on the same circuit by means of a control switch fitting any standard 2-in. switch box. Transformer can be remotely surface mounted in a basement, attic or nearby closet. Standard $4\frac{1}{2}$-by $2\frac{3}{4}$-in. switch plate and gold-trimmed control knob blend into decor of any room. Dimmer handles up to 600 watts of incandescent alone, fluorescent alone, or incandescent and fluorescent lighting together. Where on-off control from several locations is desired, 3-way switches may be installed wherever they are wanted. Protection against overloads or short circuits is provided by a circuit breaker supplied with the unit. Control switch fits single or ganged 2-in. wall boxes. Unit is designed for 120-volt ac circuits and is UL listed.

Harvey Hubbell, Inc., Bridgeport, Conn.

Fittings **(34)**

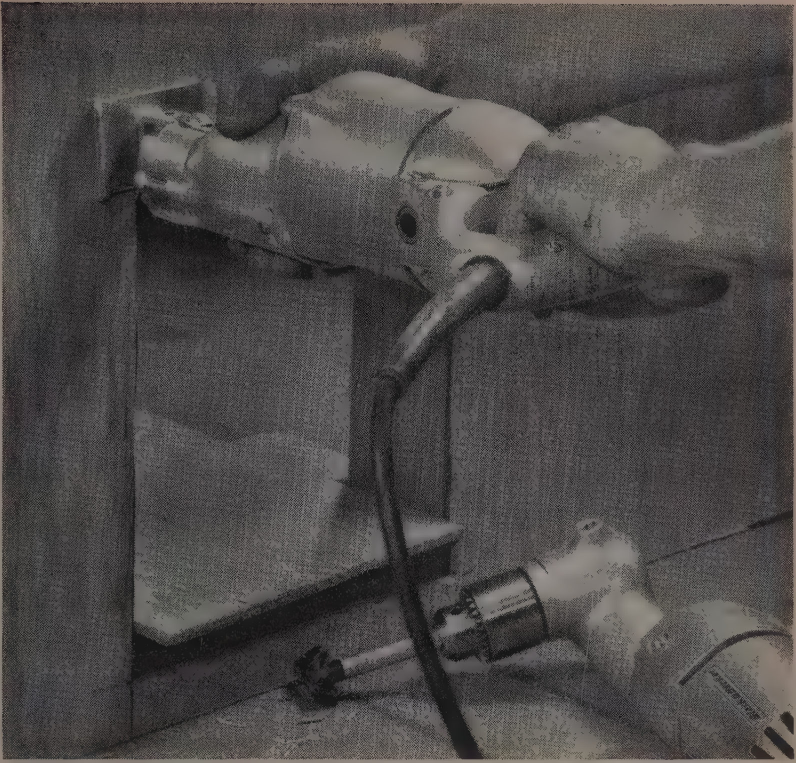
A completely redesigned line of die-cast copper-free aluminum Condulet fittings, called the Mark 9 series. They have greater internal room for wiring; self-retaining cover screws for assembly; long hubs; taper-tapped, full-cut threads for rigid joints, and integral bushing for pulling of conductors. A redesigned die-cast housing for use in standard occupancies and fittings may be used in corrosive atmospheres as well. Fittings are available in a wide selection of types and sizes from $\frac{1}{2}$ in. to 4 in., and a complete selection of wiring devices. They are UL listed and CSA approved. Bulletin 2730 is available.

Crouse-Hinds Co., Syracuse 1, N. Y.

Air Conditioner **(35)**

A new Quik-Attach air conditioner, Model TA22G, in the two-ton range, was designed to combine the flexibility of the split-system air conditioner with the factory-sealed advantages and installation ease of integral units. The condensing unit can be installed outdoors in any convenient location. The cooling coil, after being mounted in place, is connected to the outdoor unit with pre-charged tubing, using GE developed Quik-Attach fittings. The air conditioner uses a hermetically-sealed compressor.

General Electric Central Air Conditioners, Troup Highway, Tyler, Texas



CUT IT ALL

. . . with Black & Decker Sabre Saw's exclusive long-stroke action

Wood, metal, plastic or plaster . . . the B&D Sabre Saw cuts clean through everything. Faster, too, with its exclusive long-stroke action. Unique rock 'n' lock shoe design makes one-handed sawing on any surface a cinch. Safeguard blade guide gives you up-front control, adjustable blade spindle makes perfect pocket cuts. Start to finish is shorter than ever before with the B&D Sabre Saw.

Black & Decker®
CUTS MAN-HOURS TO MINUTES

New, Sturdy, B&D Sabre Saw Kit makes taking the tool to the job easier, tool-protection no problem. Also contains 5 new B&D Blades for all-purpose use.

PUZZLED
about
Time Controls?

PARAGON
ALWAYS
CONTROLS

specify
PARAGON
to solve any
timing problem

* 7-DAY TIME CONTROL
WITH 4-POLE SWITCH...
ALLOWS A WEEKLY SCHEDULE WITH
INDIVIDUAL DAILY SETTINGS...ANY DAY
OR DAYS CAN BE OMITTED

Here's another important development by PARAGON. It's the automatic MULTI-PURPOSE, 7-day Time Control with 4-pole switch . . . each pole isolated for 40-amp capacity.

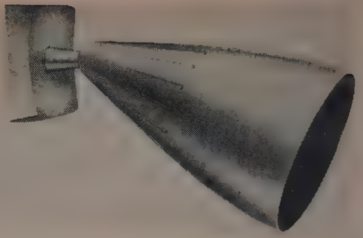
This 7000 Series Paragon Time Control allows a weekly schedule with daily settings . . . turns ON and OFF automatically at different hours each day . . . easy to set a week in advance and changed as desired . . . any day or days can be omitted, It's the ideal control for heating, ventilating and air-conditioning in schools, public buildings, offices and factories.

Two outstanding design features include:

- FOUR-POLE, 40 AMP RATING...Controls four different voltages. Each switching contact is completely isolated. This design allows the same switch to do the work of all the various 7-day controls available in the industry.
- EASY INSTALLATION...Ample wiring, gutter space... convenient knockouts—large terminal screws.

For fast delivery . . . complete details on any Paragon Time Control... location of Service Center . . . contact your authorized Paragon Distributor. He carries a full line in stock, and is highly qualified to offer technical assistance on any application.

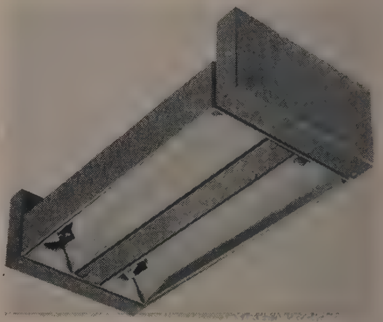
AMF | **PARAGON ELECTRIC CO., INC.**
Subsidiary of American Machine & Foundry Company
1614 TWELFTH STREET • TWO RIVERS, WISCONSIN



Lights **(36)**

Aluminum fixtures, identified as "Designer Lights," are versatile for both indoor and outdoor applications. A feature of the styling is the concealment of the universal swivel which is blended within the nose contour. Three basic styles, deep, shallow and deep flared for PAR-38 and R-40 lamps are furnished in a choice of colors. Single units or clusters of two, three and four units on 4$\frac{11}{16}$-in. square mounting flange permit varied lighting treatments. These combinations can also be furnished with pendant stems 22-in. or 42-in. over-all length, for lower-level fixture suspension.

Steber Division, Pyle-National Company, 2700 Roosevelt Road, Broadview, Ill.



Infrared Fixtures **(37)**

Two new infrared heating fixtures, specially designed for use in unsheltered outdoor applications. One model is designed as a hanging fixture and may be chain mounted or supported by either a vertical or horizontal stem. Typical applications for this type are swimming pools, patio areas, car lots, outdoor amusement areas, walkways, transit platforms, etc. The other model is designed for mounting to horizontal surfaces such as hotel, apartment or theater canopies, etc. This fixture is also recommended for indoor flush ceiling applications where styling is a factor. Both fixtures feature weatherproof housings. Fixture reflectors are anodized aluminum and are hinged to allow relamping. Fixtures are available equipped with two T3 tubular quartz infrared lamps for use where both heat and light are desired or infrared quartz tubes for heat without light applications. Design manual is available.

Luminator, Inc., 120 North Peoria, Chicago 80, Ill.

Floor System (38)

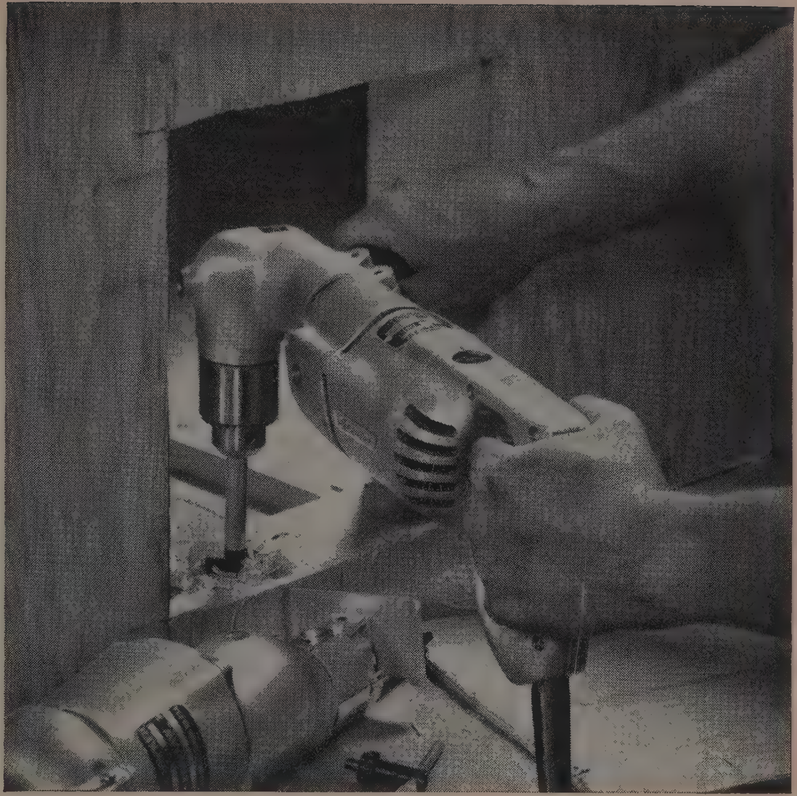
A new floor system for building construction, called the "A-E (air-electric) Floor," has been developed. The system provides for all the conditioned air and the cells for power, telephone, and other wiring. The system for underfloor distribution of conditioned air and electrical services may be used with any structural system in new construction. It is also adaptable for modernizing older structures. The A-E system basically consists of a floor supported by the main structural slab. This floor rests on adjustable steel supports creating an air space or plenum for conditioned air to be carried to floor and ceiling air diffusers. The plenum can be varied in height and can be subdivided with baffles to provide zoning of air. Within the floor, a network of cells at predetermined spacing carries wires for the various electrical and power circuits.

Granco Steel Products Co., 6506 North Broadway, St. Louis 15, Mo.

Luminaire (39)

Development of a fluorescent light to complement this line of mercury-vapor exterior lighting units has been announced. Termed Hi-Liner fluorescent luminaire, it is available in two models and is for use at intersections and in parks, drive-ins, parking lots, yards and any area where effective night-time lighting is a necessity. One model has ballast mounted vertically in bracket. Other model has ballast housed in mast-arm of unit. Both are available with a photo-electric cell to automatically control on and off sequence according to exterior lighting conditions. Luminaires are also available with a standard 3-prong twist-lock connector for photocell or without a socket or photocell. Low-wattage units can be rotated 360° and may be tilted from 0 to 90 degrees. Size of luminaire head is 50 by 6 by 6 in. Head is extendable on its own mast-arm. The 120-volt, 60-cycle unit is pre-wired.

Hi-Products, Inc., 2641 S. Louisiana Ave., Minneapolis 26, Minn.



DRILL IT RIGHT

. . . with the Black & Decker Right Angle Drill's reversible head

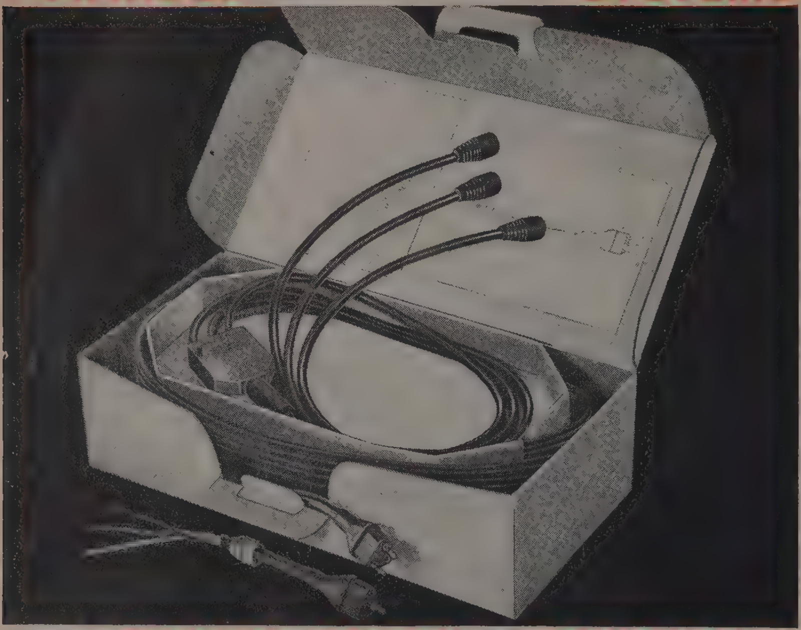
Give your construction and maintenance jobs the right twist . . . with the B&D Right Angle Drill's reversible head for 3/8" to 1 1/8" capacities in wood. One end gives you slower speed, higher torque . . . the other, higher speed with less torque. Both get around corners, in between pipes and joists with equal ease. You'll find the B&D Right Angle Drill the top tool for installing pipe or BX and conduit. Cuts user-fatigue with easier handling, quick operation.

Black & Decker
CUTS MAN-HOURS TO MINUTES

SPECIAL INTRODUCTORY KIT OFFER . . . $95
Regular Price $104.50
LIMITED TIME

Husky B&D Right Angle Drill Kit makes this handy tool handier. Perfect for safe keeping. Contains hex socket wrench, gear chuck, reversible handle and 3-wire cable.

PORTABLE Power Distribution SYSTEMS



offer GREATER SAFETY • CONVENIENCE

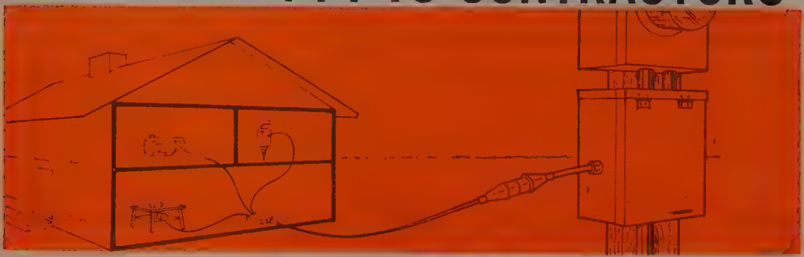
WB TUFFLINE Power Systems carry electric power from temporary service or portable generators wherever needed at construction sites.

These systems are made of rugged 3 conductor DYNAPRENE SO cord permanently molded to tough, waterproof neoprene connectors.

Extensions are available so that additional length and additional outlets are obtainable.

Write for complete details in Bulletin TL-2 . . . it's free.

. . . TO CONTRACTORS



TUFFLINE DIVISION

WB WHITNEY BLAKE CO.

New Haven 14, Connecticut • Telephone: CHestnut 8-5515 . . . TWX NH84

Catalogs & Bulletins

(40) ALUMINUM CONDUCTOR. "Tentative Packaging Standards for Bare Stranded Aluminum Conductor and ACSR" designates 12 reels, seven of wood and five of metal, to accommodate all standard types of bare stranded aluminum electric conductor and ACSR. Aluminum Electrical Conductor Div., Aluminum Association.

(41) WEDGE CLAMPS for service cable dead-ends are described in four-page Bulletin 6105. Jasper Blackburn Corp.

(42) LIQUID-TIGHT CONDUIT. Bulletin S-544 describes "Sealtite" flexible liquid-tight wiring conduit. Anaconda Metal Hose Div., Anaconda American Brass Co.

(43) CONDUIT AND FITTINGS. Bulletin PB-101 describes "Plasti-Bond" permanently PVC-coated rigid conduit systems for corrosion-resistant applications. Pittsburgh Standard Conduit Co.

(44) DRILL. "How to Use the Roto-Imp" illustrates and explains methods and techniques for drilling holes up to 6 in. in diameter in reinforced concrete with Roto-Imp tool. Roto-Imp Tool Div., Bill Jack Scientific Instrument Co.

(45) CABLE. Brochure 611-A covers an entirely new method for installation of spacer-type aerial cable called the continuous stringing system. Sherman and Reilly, Inc.

(46) MOTORS. Bulletin 115 features the various applications of motors and adjustable-speed drives in the paper industry. Louis Allis Co.

(47) FLOOR BOX. 4-page brochure F13-144 lists a new line of adjustable underfloor boxes and accessories for shallow and normal fill floors including a large capacity box which accepts up to 1½-in. conduit. Thomas & Betts Co.

(48) ELECTRIC MOTORS. Booklet No. 502 describes low-speed synchronous motors from 20 to 10,000 hp and from 72 to 450 rpm. Ideal Electric and Mfg. Co.

(49) **Electrical Conduit.** 8-page brochure describes new line of rigid PVC plastic pipe, newly approved for use as electrical conduit, produced in sizes ranging from ½ in. to 6 in. in diameter. Lasco Industries.

(50) **Closed-Circuit TV.** Booklet describes how closed-circuit television can be used for surveillance, transportation and dispatching, cost reduction and quality control, merchandising, security, observation of hazardous locations, education and in hospitals. Electronics Div., Fairbanks, Morse & Co.

(51) **Emergency Lighting Units.** Technical handbook describes Exide's line of automatic battery-powered Lightguard emergency lighting equipment. Exide Industrial Marketing Div., Electric Storage Battery Co.

(52) **Lighting.** 4-page booklet describes indoor and outdoor decorative holiday lighting. Steber Div., Pyle-National Co.

(53) **Strip-Lighting** line is described in catalog including high-output commercial fluorescent, new slimline, all-purpose strip, and all-purpose industrial fluorescent. Moe Light Div., Thomas Industries Inc.

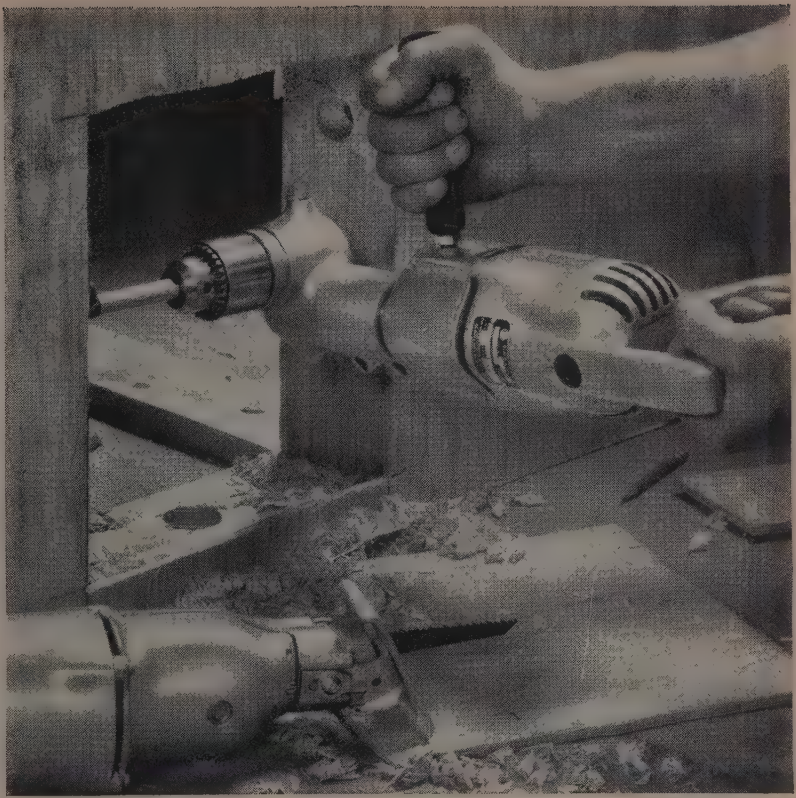
(54) **Radiant Heat.** 8-page brochure explains the principle of radiant heat and describes Fostoria's equipment designed for utilization of the electric infrared radiant heating process. Fostoria Corp.

(55) **Floodlight.** Bulletin No. MF-261 describes the new "Mercflood" floodlight, one of the new line of Appleton "Intenso" floodlights. Appleton Electric Co.

(56) **Luminaires.** 10-page booklet B-8235 describes the Mark II Mainliner, a new line of commercial recessed fluorescent luminaires. Westinghouse Lighting Div.

(57) **Switch Equipment.** 4-page Bulletin GEA-7186 discusses new stationary housed switch and fuse equipment rated 2.4 to 15 kv. General Electric Co.

(58) **Solenoid Valves** with UL listing are described in Bulletin 710-Q. J. D. Gould Co.



DRILL IT ANY WAY

...with Black & Decker Right Angle Drill's 360° self-locking swivel head

Right from the start, you'll find the Black & Decker Right Angle Drill has a head for getting around corners. It goes to any degree (up to full 360°) and locks, to get into tight places. Its 2-speed head at the business end, removable handle for use on either side, its heavy-duty ball-bearing construction throughout . . . all make this drill your right choice from any angle. Black & Decker tools are sold by leading distributors everywhere. *For sales or service, look in the Yellow Pages of your telephone book under* TOOLS ELECTRIC

Black & Decker
CUTS MAN-HOURS TO MINUTES

☐ Sanders
☐ Saws
☐ Vacuum Cleaners
☐ Hammers

The Black & Decker Mfg. Co., Dept. 1211
Towson 4, Md. (In Canada: Brockville, Ont.)
☐ Please arrange for a demonstration of..................
☐ Please send me more information on..................
Name..................Title..................
Company..................
Address..................
City..................Zone.....State..........

Rugged Design...
Easy-to-Handle Balance

RIDGID®
HEAVY-DUTY
PIPE
CUTTERS

give faster, straighter cuts

Five Sizes
for 1/8" to 6"

FACTORY TESTED

Pick up a RIDGID Heavy-Duty Pipe Cutter, and you'll instantly know why it makes pipe and conduit cutting far easier. Perfectly balanced . . . gives you a feel of confidence no other cutter can match. See the extra-long shank that protects handle threads . . . assures easy pressure application. Feel the large, smooth handle that gives you a comfortable, powerful grip. Try it, and you'll find a built-in cushion to keep the cutter wheel "on track" through hard or uneven spots. Rugged frame, guaranteed not to break or warp, stays straight for clean cuts every time.

You'll Want a RIDGID 4-Wheel Pipe Cutter for Work in Tight Places!

Call your Distributor today. For your convenience, he maintains a complete stock of RIDGID Work-Saver Pipe Tools and Parts!

RIDGID®
The Ridge Tool Company, Elyria, Ohio, U.S.A.

(59) TELEVISION SYSTEMS. General applications of closed-circuit television systems are presented in 8-page Catalog 6-205. Kin Tel Div., Cohu Electronics, Inc.

(60) OIL CIRCUIT BREAKERS for 14.4 and 23-kv service are described in Bulletin 71B9705 entitled "5-Cycle Type OZ Distribution Oil Circuit Breakers." Allis-Chalmers Mfg. Co.

(61) INDUSTRIAL LIGHTING. 16-page industrial catalog features 116 different types of hard glass industrial incandescent and mercury reflector lamps for outdoor and indoor lighting, with lamp types and voltages to meet standard and special requirements for industry from 50 to 10,000 watts. Radiant Lamp Corp.

(62) POWER FUSES. Application Data 36-660 describes the application and selection of high-voltage power fuses. Westinghouse Electric Corp.

(63) WIRING BLOCK. 4-page folder details complete specifications on new modular terminal panel wiring block called "Termi-Blok." AMP Inc.

(64) CONTROL CENTERS. New handbook describes laying out and designing any control center, special or standard. Monitor Controller Div., Atlee Corp.

(65) CONDUIT AND FITTINGS. 6-page bulletin offers installation information and specifications for underground plastic conduit and fittings for use in both concrete encasement and direct-burial installations; and 2-page bulletin describes specifications and offers installation instructions for Polyvinyl Chloride (PVC) lightwall and heavywall conduit. Consolidated Pipe Co. of America.

(66) SILICONE RUBBER compounds now available for use as wire and cable insulation are described in 8-page Technical Bulletin S-4. General Electric Co., Silicone Products Dept.

(67) MOTORS. 6-page Bulletin L-3314A describes full line of ac general-purpose integral-hp motors. Kingston-Conley, Inc.

(68) SERVICE LIGHTS. Bulletin LV describes new line of LV-Series low-voltage service lights. Electrical Div., McGill Mfg. Co., Inc.

(69) INDUSTRIAL RELAYS. Bulletin GEA-7329, 12 pages, describes new 10-amp, 300-volt industrial relay designed to cut control-panel space requirements. General Electric Co.

(70) CONTROL CABLES. 30-page catalog gives complete data about Bronco multi-conductor electrical cables used in control circuits. Western Insulated Wire Co.

(71) DRY-TYPE TRANSFORMERS. 8-page booklet entitled "9 Ways to Make Cheap Dry-Type Transformers" informs and alerts unsuspecting buyers to the pitfalls encountered in buying low-cost dry-type transformers. Atlantic Transformer Co.

(72) TRANSFER SWITCHES. Bulletin 906-105 describes new 1200-, 1600- and 2000-amp mechanically held transfer switches and illustrates the 2000-amp vertical tandem switch. Automatic Switch Co.

(73) LEAK DETECTORS. Bulletin GEA-6817-A describes Type H line of portable, halogen sensitive, electronic leak detectors for industry, research and defense applications. General Electric Co.

(74) SWITCHES. Data Sheet 190 describes high-capacity Type M basic switches. Micro Switch.

(75) FLOODLIGHT. Bulletin QL-15-161 describes new "Quartzlite 1500" floodlight similar to "Quartzlite 500" but makes use of the new 1500-watt Quartz-Iodine lamp. Appleton Electric Co.

(76) ELECTRICAL PRODUCTS. 25 new pages of catalog data sheets (EP-825) cover metallic, helically formed and plastic products. Electrical Products Div. The Fanner Mfg. Co.

(77) REPAIR KIT. Bi-Cast splicing, terminating and repair kit data are contained in 8-page booklet including application information. Bishop Manufacturing Corp.

(78) HIGH VOLTAGE TEST SETS are described in 4-page bulletin including the new line of high voltage ac test sets. Peschel Electronics Inc.

(79) MOTORS. Instruction manual covers its Type HU oil-lubricated motors, frame sizes 254 UP through 445 UP. U. S. Electrical Motors Inc.

World's Fastest, Smoothest Hand Reaming

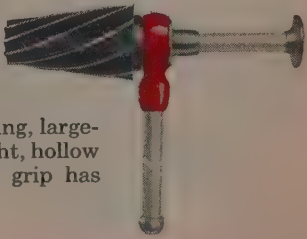
Self-Feeding RIDGID® No. 2-S Spiral Reamer

...reams pipe, conduit, sheet metal and wood!

Try a RIDGID Spiral Reamer, and you'll quickly feel how it reams its way into pipe, conduit, metal holes or wood without effort. Heat-treated cutting edges give maximum service life. Ratchet-action handle makes work easy in close quarters.

Now Available...
RIDGID No. 254 Spiral Reamer
for 2½" to 4" Pipe and Conduit

No more hand filing . . . here's the time-saving, large-size hand reamer you've always needed. Light, hollow construction makes handling easy. Hand grip has large butt plate for body pressure.



Call your Distributor today. For your convenience, he maintains a complete stock of RIDGID Work-Saver Pipe Tools and parts!

RIDGID®
The Ridge Tool Company, Elyria, Ohio, U.S.A.

Sold Through Recognized Distributors Only

TRADE ARRO MARK

ARRO EXPANSION BOLT CO.
P.O. Box 388 • Marion, Ohio

SUMMARY OF SALES AND COSTS

SALES:	
Original Contract	$ 97,100
Extras—20 x $600 (av.)	12,000
Total	$109,100
COSTS:	
Original Contract (incl. overhead)	$ 90,528
Cost of extended duration	485
Extras—20 x $639 (av.)	12,780
Total	$103,793
PROFIT	
Total sales	$109,100
Total costs	103,793
Profit	$ 5,307

FIG. 4—Summary of sales and costs of complete project (original contract plus all extras). Note over-all profit is less than that estimated for original contract alone.

To arrive at an approximate amount, use the extended-duration formula (see Electrical Estimating, McGraw-Hill Book Co.). From this formula the cost is:

$$\text{Cost per month} = \frac{10\% \text{ of contract price}}{\text{months duration (normal)}} \quad (1)$$

Normal duration of the original contract was approximately five months. Assume that change orders added another 0.5 month. Then, substituting in Formula 1, we would have:

$$\text{Cost per month} = \frac{0.10 \times 97{,}100}{5}$$

$$= \$1{,}942$$

$$\text{Cost per } \tfrac{1}{2} \text{ month} = \frac{\$1{,}942}{2}$$

$$= \$971 \text{ (use 970)}$$

To offset any duplication of charges that might be included, use one-half this amount. Thus, the $485 "cost of extended duration" in Fig. 4. Here we have total costs (original contract, extended duration, extras) of $103,793. Receipts (selling price) for the complete project total $109,100. The difference between the two is a profit of $5,307. Compare this with the estimated profit of $6,572 (Fig. 1) on the original contract alone, and you see how the contractor came out. The "extras" cost the job (and the contractor) $1,265.

Some readers may be surprised at these results. Contractors who follow their jobs carefully will not.

The charges used in the example are not too high. In fact, the $485 figure covers all excess labor and carrying costs due to job interruptions and shifting of men. It is extremely low.

One may question the $163 labor overhead charge in Fig. 3. Try to prorate it and it does seem excessive. The experience is the same with any overhead. Besides, small orders must absorb costs that usually can be included as direct job costs on larger projects.

Then, there is a so-called "lost motion" cost experienced on all projects. Usually, it is an essential part of the day's work. However, the smaller the contract the greater is the portion of this time that is included in overhead.

In the case of estimators and engineers, such lost motion consists of time spent in shifting jobs, time for reviewing completed work, the natural letdown after finishing a heavy job, and all the normal interruptions. Much of this time on large projects is charged as a job cost. It is hard to identify such time with small orders.

Contractors must be prepared to take losses on small orders. There are times when trying to collect a "just" price causes friction and consumes more time than the order is worth. Small extras usually are a nuisance and the contractor is fortunate when he can complete a large project without being confronted with them.

Save time and money installing cable in conduit . . . protect cable from damage . . . assure service continuity . . . with a cable lubricant engineered for your job's requirements.

Because conditions vary from job to job—diameter and length of cable, kind of insulation, number of bends, friction in the duct—Burndy provides these **four** tested cable lubricants, for a variety of service conditions. One of the four is the Burndy lubricant for your job . . . ask Burndy to help you select the cable-pulling lubricant you need.

Burndy SLIKON, for cable covered with rubber, many kinds of plastic, or lead, for installation in steel or aluminum conduit.

Burndy ALBENTONITE CABLE LUBRICANT, for cables with polyethylene and similar insulations.

Burndy IMPROVED CABLE PULLING COMPOUND, specifically for lead-covered cable for installation in ducts of all types.

Burndy PROTECTANT 626, for lead covered cable for installation in ducts and manholes subject to flooding and other severe conditions.

BURNDY

61-19

NORWALK, CONNECT. BICC-BURNDY Ltd. Prescot, Lancs., England In Europe: Malines, Belgium TORONTO, CANADA

POLYETHYLENE
INSULATED POWER CABLES

Now SIMPLEX technology brings polyethylene's outstanding characteristics to higher voltage applications.

- Proved in Performance
- Economical
- Low Weight
- At least seven-fold improvement in voltage life of polyethylene
- Specific Inductive Capacity Less than 2.5
- Power Factor Less than .001
- High Impulse Strength
- For Wet, Dry, Overhead and Underground Installations

Send for complete details

POLYETHYLENE CABLES BY Simplex
WIRE & CABLE CO.

EXECUTIVE OFFICES: Cambridge, Massachusetts • PLANTS at Cambridge, Massachusetts and Portsmouth, New Hampshire

Reader's Quiz

QUESTIONS from readers on problems of industrial equipment, installations, maintenance and repairs. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Ballast Fuse Protection

QUESTION D40—In a recently completed plant, we are having difficulty with mercury-lamp ballasts blowing fuses for no apparent reason. The fuses are installed in the ballast terminal boxes and are solely for the purpose of indicating which ballast is faulty. Each of the constant-wattage ballasts supplies two 400-watt H331GL/C lamps, and there are 12 such ballasts on each 30-amp, 3-phase branch circuit, balanced across the phase conductors of a 480/277-volt grounded system. Ballasts are rated 400 to 520 volts input, 1.9 amps.

Switching is done by means of a 3-pole contactor for each 3-phase branch circuit. Five-amp fuses are blowing frequently, and the only pattern we can detect is that as many as five fuses on a circuit have blown when the circuit was opened and immediately reclosed, in spite of the fact that starting current for this ballast is less than operating current. Fuses also have blown during normal continuous operation. The following steps have already been taken:

1. Suspicious ballasts have been checked, found okay.

2. Terminal box temperature, 122°F, has been declared not responsible (by fuse manufacturer).

3. Fuse connections have been checked and found okay.

4. Ballast manufacturer has set up a laboratory test and is unable to find excessive current.

5. System voltages have been checked and recorded. (470 to 458).

6. We have substituted 10-amp fuses in over a hundred cases, and none of these have blown, nor have the ballasts given trouble.

7. No lamps have burned out, nor have any of the 30-amp branch-circuit fuses blown.

What would you suggest next, in order to enable us to use fuses small enough to blow when a ballast fails before the branch-circuit fuse blows?—W.S.W.

ANSWER TO D40—Your description indicates that you have 3-wire, 3-phase, 480-volt, 30-amp branch circuits, each supplying 12 2-lamp M-V ballasts. Four of these phase-to-phase-connected ballasts are connected to phases AB, four to BC and four to CA per branch circuit. This means that the line current for each conductor of each branch circuit will be about 13 amps (1.9 × 4 × 1.73) since in balanced 3-phase circuits, $I_c \times 1.73 = I_L$. Naturally, 13 amps is less than half of the rating of the 30-amp branch-circuit overcurrent devices; so it would take considerably more load to trip the 30-amp devices. Unfortunately, you do not indicate the type of 5-amp fuse used for each ballast. Was it a "quick-blow" or "slow-blow" type? This is important. For protecting fluorescent ballasts, the "quick-blow" types have been recommended and used in many installations. But I would not recommend such a small-size "quick-blow" type with mercury-vapor ballasts, particularly in your situation where the ballasts are the constant-wattage (regulated-output) types and where the temperature is 122°F at the fuse. Generally, fuse ratings are based on ambient temperatures from 68°F to 80°F, depending on the type of fuse. Where the ambient temperature increases, the normal carrying capacity and blowing time of a fuse decreases, which means your 5-amp fuse will undergo some derating due to the laws of physics. Another factor is that the fusible link in a fuse has a temperature rise in proportion to the ampere load through it. As a result, it is understandable why your 5-amp fuse blows when you open and immediately close one of the lighting circuits. The sudden inrush current to the inductive load, the high ambient, and the warmed-up fuse element are too much of a handicap for the 5-amp fuse. In addition, the starting line current you speak of concerns the warmup period of the mercury-vapor lamp and not the initial inrush current.

The final consideration concerns your ballasts, because constant-wattage or regulated-output types use regulating properties of a saturated magnetic element to maintain the lamp wattage nearly constant over a line voltage of plus or minus 15%. Considering that the nominal line voltage is about 460, and that you have recorded voltage variations from 470 to 458, it is significant to note that your nominal line current of 1.9 amps will increase as the line voltage dips below 460. And actually the voltage could dip considerably below your minimum recording of 458 volts when certain heavy power equipment is started.

As a solution to your problem, substitute the 5-amp fuses with the type and rating capable of coping with the conditions previously outlined.—O.A.K.

Paralleling Magnet Wires

QUESTION E40 — Do motor rewind shops consider substituting magnet wire by pairing two smaller sizes for a larger one? Is this a good practice? Also, does two of every third smaller size equal the original; for example, two No. 20 wires equal to one No. 17, or two No. 14 wires equal to one No. 11. Does this hold true in all wire sizes?—E.S.H.

ANSWER TO E40—In regard to the use of the two wires of ½ the circular-mil area in place of one wire of two times the circular mil area, it is easier to feed the smaller wires through the slot opening, thereby saving time in winding—although the smaller wires take up slightly more over-all space in the slot. The small wire coils are also easier to shape if this is a problem. As for being good practice, I can see nothing wrong with it except it is not necessary in most cases.

As to the second part of your question you are right in assuming that one No. 17 is equivalent to two No. 20 wires. The graph of the American or Brown and Sharpe gage is a straight line; therefore, it is true that any wire is equal to two smaller gage wires three sizes smaller. This is true from one end of the gage to the other.—M.H.

ANSWER TO E40 — Yes, motor winders do utilize the practice of substituting two smaller wires for a larger one. This is considered good practice and is used. However, it should be resorted to only when

Four

. . . not three .
The United
of Standards

Champion

is one of
. . . and has
more than

Specializing

in industrial
Champion
into retail

Our prices

reflect the
compare our
on any of

For details, contact Champion distributors or .

Lamp Specialists Since 1900

CHAMPION LAMPS

LYNNWAY, LYNN, MASSACHUSETTS
LYnn 3-2000

CHAMPION
LAMPS

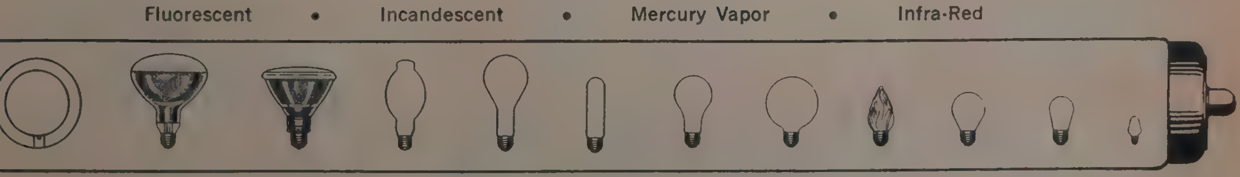
. lamp lines carry
States Bureau
quality approval.

these approved lines
been for
twenty-five years.

and commercial lighting,
does not have to pour millions
lamp and appliance merchandising.

saving. It will pay you to
discounts with those you are getting
the other three approved brands.

. Mr. Bill Ferris at our Lynn plant.


Fluorescent • Incandescent • Mercury Vapor • Infra-Red

BOSS ELECTRICAL ENCLOSURES

BOSS

When you need consistent high quality and dependable, fast delivery, call for BOSS electrical enclosures.

BOSS J.I.C. and NEMA wiring boxes, trough and wireway provide protection against oil, water, dust or dirt. All BOSS boxes and wireway are phosphatized before baked enamel finish is applied.

"Specials" are quoted promptly, fabricated accurately to your specifications and serviced for quick shipment.

Write for catalog which shows the complete line of BOSS products carried in stock for immediate shipment. Sold through leading electrical distributors everywhere.

THE HUENEFELD CO. ENGINEERED PRODUCTS DIVISION
2705 SPRING GROVE AVE. CINCINNATI 25, OHIO

the larger wire is rather stiff and unwieldy. The relationship you stated is true as shown by this partial table.

Gage Number	*Area in Circular Mils*
19	1,300
16	2,600
13	5,180
10	10,400
7	20,700
4	41,600

The area of any wire can be calculated by the following formula using the area of the No. 10 wire as a base: (10,400 circular mils). Area No. N Wire = 10,400 × $(126)^{(10-n)}$. That is, the area of any wire is equal to the area of the No. 10 wire times 1.26 raised to the (10-n) power.—J.A.M.

Commutator Troubles

QUESTION F40—Copper is forming on the trailing edge of the commutator bar on one of our large dc machines. This eventually builds up in the undercut slots and short circuits the bars. To date we have been unable to correct this condition permanently. Can someone with similar experience suggest the cause and correction?—R.E.B.

ANSWER TO F40—The abnormal build-up of copper at the trailing edge of the commutator bar on dc machines can generally be traced to four contributing factors:

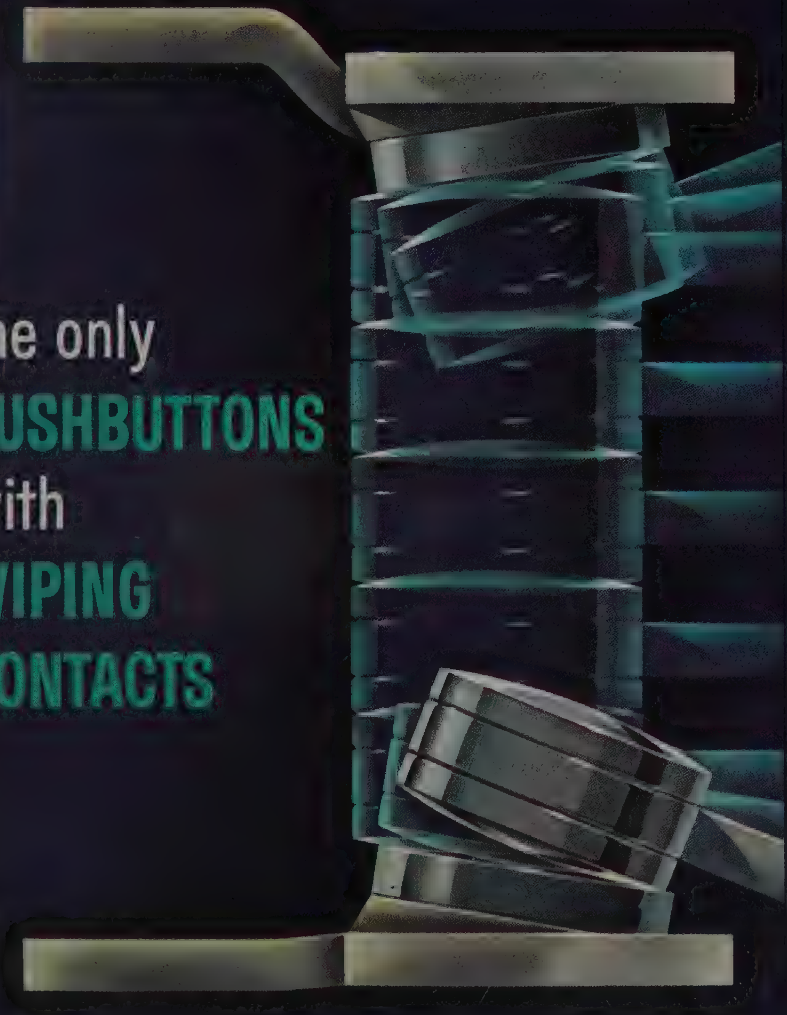
1. Too light a brush pressure exerted on the carbon brushes by the brush-holder pressure device.
2. Machine vibration.
3. The use of an abrasive hard brush. Changing the type of brush material would, therefore, help.
4. If the atmosphere around the commutator area is contaminated with gas, copper drag might appear. By directing a flow of fresh air in the commutator area, the copper drag effect should be minimized.—H.W.

ANSWER TO F 40—The answer to your problem is relatively simple, but I say this with "tongue in cheek" as we recently solved a very similar problem and now know the answer.

First, where does this copper come from? Unfortunately, it is coming from the commutator bars. If this condition is permitted to continue, your large dc machine will be destroyed. Here the old saw, "an ounce of prevention . . ." really applies.

Second, why is this copper coming from the commutator bars?

the only PUSHBUTTONS with WIPING CONTACTS



STANDARD PUSHBUTTON

SELECTOR SWITCH

PUSH-TO-TEST LIGHT OR LIGHTED PUSHBUTTON

PILOT LIGHT

Touch a finger to any Clark pushbutton, and there's positive response *every* time.

Why are Clark control units more dependable than others? Because, with each operation, the fine silver contacts are cleaned. The rolling, wiping action between the movable and stationary contacts as they make or break the circuit, wipes off any dust or non-conducting film that may be present. It's a Clark exclusive.

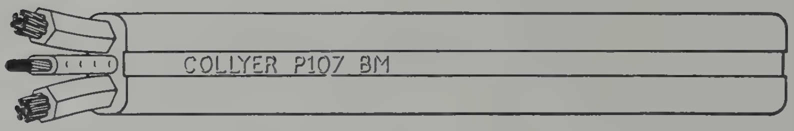
But this is only one of many features that make Clark pushbutton units the most reliable and versatile on the market. Ask your Clark distributor or sales representative to show you how the sturdy construction, ease of wiring and maintenance, and flexibility will help solve *your* pushbutton problems. 61PB2

COLORS? YOU NAME IT, WE'VE GOT IT! You can select from seven different colors for your pushbutton operators, lenses and ferrules. Groups of related control units can be coded by ferrule color, specific functions by operator color—another Clark original to help simplify otherwise complicated control stations. With Clark's complete line of control units, utilizing interchangeable operators, ferrules and nameplates, you have a virtually unlimited number of combinations of electrical functions and colors from which to choose.

THE CLARK CONTROLLER COMPANY

MAIN PLANT: CLEVELAND, 10 • WESTERN PLANT: LOS ANGELES, 58
IN CANADA: CANADIAN CONTROLLERS, LIMITED, TORONTO, ONTARIO

Progress report from COLLYER . . .



Collyer TWIN PARALLEL TYPE G POWER CABLE with HEX-SHAPED CONDUCTORS – a progressive contribution to LONGER LIFE of PORTABLE 600-VOLT CABLE

Here is why and how it will help you

Designed for heavy duty

Collyer Twin Type G Portable Cable meets or exceeds all specifications for use as trailing cable for mobile or portable equipment in outdoor and indoor locations where it must withstand hard usage and exposure to moisture, oil, grease and heat. Typical applications include mining machines, shuttle cars, drills, conveyors, shovels, dredges, cranes and welding machines.

It can't twist or shift

Three construction features control the internal stresses and strains that tend to shorten the flexing life of ordinary heavy-duty portable cable.

1. Outer strands of the two power conductors have opposite directions of lay. This increases the life of the cable by balancing the forces at work inside the cable during hard usage.
2. Internal stability is further increased by the hexagonal shape of the insulated power conductors. This feature provides maximum locking surface between insulation and jacket to eliminate internal twisting.
3. The non-twist lock between insulation and jacket does not reduce flexibility because reinforcing nylon braid *over* each insulated power conductor and *around* the assembly of the parallel power and ground conductors provides controlled longitudinal play.

Insulation is natural rubber

Each power conductor is insulated with properly vulcanized natural rubber compound . . . tough, resilient and highly resistant to heat and physical abuse. The natural rubber hugs conductors with a tight grip . . . and protects them against compression cutting. The double layer of nylon reinforcing braid also helps resist crushing.

Jackets are super-tough

A special formulation of neoprene . . . high in both tensile and tear strength . . . gives Collyer Twin Type G Cable extra ability to take hard usage. Vulcanized in a continuous lead mold, these jackets are highly resistant to abrasion, tension, heat, oil and grease.

Choice of nine sizes

Collyer Twin Type G 600-Volt Cable with Grounding Conductors is available in conductor sizes 6, 4, 3, 2, 1, 1/0, 2/0, 3/0 and 4/0, to IPCEA specified dimensions.

For more information, ask your Collyer Distributor or Agent . . . or write for Specification #5.6.60 to COLLYER INSULATED WIRE CO., 265 ROOSEVELT AVE., PAWTUCKET, RHODE ISLAND.

Collyer Cables

There are two reasons: 1. excessive abrasive action caused by extremely hard brushes, 2. improper brush location. Abnormal sparking at the brushes on a newly turned-down commutator indicates improper brush location. Reset the brushes. However, in the majority of the cases, brush hardness is the problem. On a newly turned-down commutator, with brushes of proper hardness, adjusted to the correct tension, the commutator will soon become glazed with the highly polished surface and a deep brown color. If this does not occur on your machine your brushes are too hard. The choice of a proper grade of brush for a particular machine calls for expert judgment as a result of wide experience with brushes and commutator problems and should be referred to a brush specialist. This was our problem and we solved it by contacting a reputable brush manufacturer.—J.A.M.

Short-Circuit Calculations

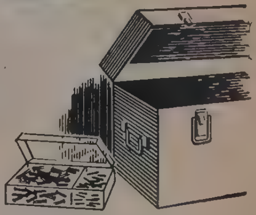
QUESTION G40—In short-circuit calculations, how does one go about obtaining or calculating the reactance of the utility supply system? What is meant by the term "infinite bus"?—J.A.M.

ANSWER TO G40—I assume that you are trying to determine the short-circuit current or kva which is available from your utility's distribution or transmission system at your particular plant location in order that you may determine the required fault duty of the switchgear or circuit breakers in the plant.

I commend you in your recognition of the fact that adequate interrupting capacity of fuses, breakers, etc. is as equally important (if not more so) as adequate rating in respect to voltage, current-carrying capacity, etc. Too often this requirement is overlooked or neglected.

First, forget about utility reactances and impedances. Contact the utility power sales engineer who services your area and ask him to determine the maximum fault current or kva available at your location. I suggest this for four reasons:

1) The actual value of the utility system reactances and impedances would not be of much help to you since you would also have to know the kva capacities of the various utility substation transformers



RAWL CONTRACTOR KITS put the drills, anchors, and **screws**, in the sizes you need, on the job where you need them. Each kit contains a high-quality Rawl spiral carbide drill, 100 genuine Rawlplugs, and 100 matching pan-head screws . . . all in one sturdy, reusable box.

Rawl Contractor Kits come in three popular sizes . . . use the handy coupon to put one in each of your tool boxes.

Kit No. R-8 includes:	Kit No. R-10 (shown) includes:	Kit No. R-12 includes:
100 #8 x 1" genuine Rawlplugs	100 #10 x 1" genuine Rawlplugs	100 #12 x 1" genuine Rawlplugs
100 #8 x 1" pan-head screws	100 #10 x 1" pan-head screws	100 #12 x 1¼" pan-head screws
1 #8(11/64") Rawl carbide drill	1 #10(3/16") Rawl carbide drill	1 #12 (¼") Rawl carbide drill

R 34

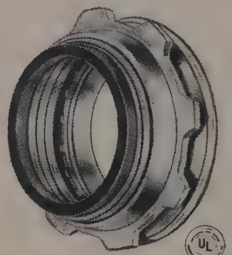
The **RAWLPLUG** Company, Inc.
212 Petersville Road, New Rochelle, N.Y.

Please rush ________ (quantity) R-8 Contractor Kits @ $4.13 $________
________ R-10 Contractor Kits @ $4.60 ________
________ R-12 Contractor Kits @ $5.40 ________
Total $________

Name ________
Firm ________
Address ________

TOMIC DOES IT AGAIN—with a revolutionary new All-Purpose Thinwall Fitting that packs every famous TOMIC Tap-On feature into a single fitting that meets all your thinwall requirements!

NEW INSULATED, BUSHED EMT RAINTIGHT TAP-ON FITTING



Patents: 2458276, 2986060

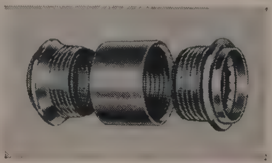
- **IT'S RAINTIGHT** OK for outdoors or in-concrete slabs!
- **IT'S BUSHED** No inside ridges to snag fishtape or fray wire!
- **IT'S INSULATED** For extra protection against shorts!
- **IT'S ECONOMICAL** Priced right—Finest Quality!

FAST, EASY INSTALLATION . . . WITHOUT TOOLS!

Just tap or push it on...and Tomic's new Insulated, Bushed EMT Raintight Fitting becomes an *integral* part of the thinwall . . . automatically puts standard pipe thread on EMT conduits! Patented pre-flex steel locking ring grips conduit securely at multiple points for positive grounds that won't shake, jar or work loose!

TOMIC RAINTIGHT TAP-ON COUPLINGS are ideal for long runs, saddles, bends, corners, etc...permit easy changes from EMT to rigid, flex—any cable—without special adapters.

Sizes Available: No. 20: ½″ connector; No. 21: ¾″ connector; No. 320: ½″ coupling; No. 321: ¾″ coupling. Write today for prices, samples and complete information.



tomic

TODAY'S FINEST ELECTRICAL FITTINGS
PRICED TO SAVE YOU MONEY.

TOMIC SALES & ENGINEERING CO. 20,000 SHERWOOD AVE., DETROIT 34, MICH.

within the utility network, which could supply short-circuit current to your plant in the event of a fault in the plant.

2) The utility system impedances can change greatly as the distribution networks within the utlility system are sectionalized, interconnected or reinforced. The information on impedances you have today may be of no use six months from now due to reinforcement within the utility system.

3) The power sales engineer will provide you with the maximum *proposed* fault current available.

In other words, his information will allow for future reinforcement to his system. For example: the actual fault current available now may be only 25,000 amps but the addition of a new feeder or substation by the utility may raise this to 75,000 amps. Certainly, any equipment you install now should have a rated fault duty adequate to safely interrupt fault current which may be available five or ten years hence.

4) Your calculations will be greatly simplified by beginning with this given short-circuit current at your location, rather than working back through the utility system with impedances, reactances, etc., which may not be firm values. Several manufacturers supply cardboard "slide-rule type" calculators for this purpose, which can reduce the task to a rather simple operation.

The term "infinite bus" denotes a theoretical source of supply of zero impedance which in practice is impossible. However, the assumption of an infinite bus will provide you with a calculated short-circuit current that in practice cannot be exceeded under any fault conditions. —J.J.M.

ANSWER TO G40—1) To obtain the reactance of the utility supply system consult with the local power company. Let us assume that it is learned that the maximum short circuit capacity of their primary system is 110,000 kva. Further let us assume that their primary is tied to a 1500-kva transformer supplying power to your premises with a secondary voltage of 600. The "per unit" reactance

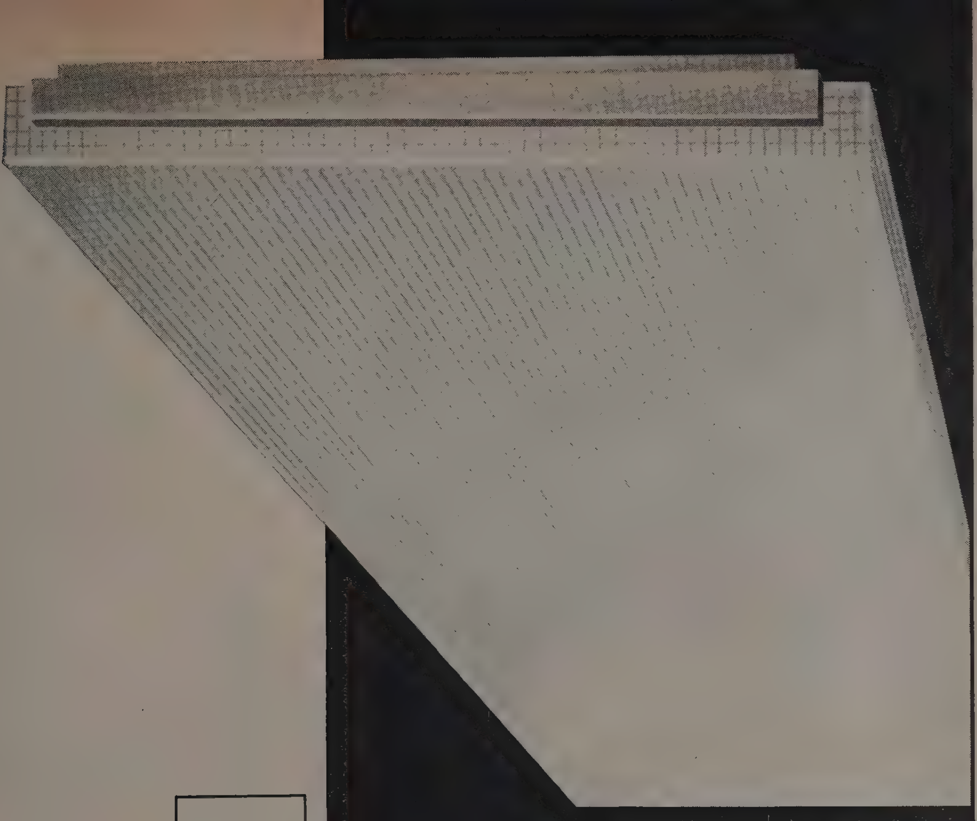
$$\frac{(\%\text{ reactance}),}{100}$$

or

Impedance if resistance is neglected is:

$1.0 \times$ chosen KVA base in this case 1500/utility S.C. kva $= 110{,}000 = 0.0136$

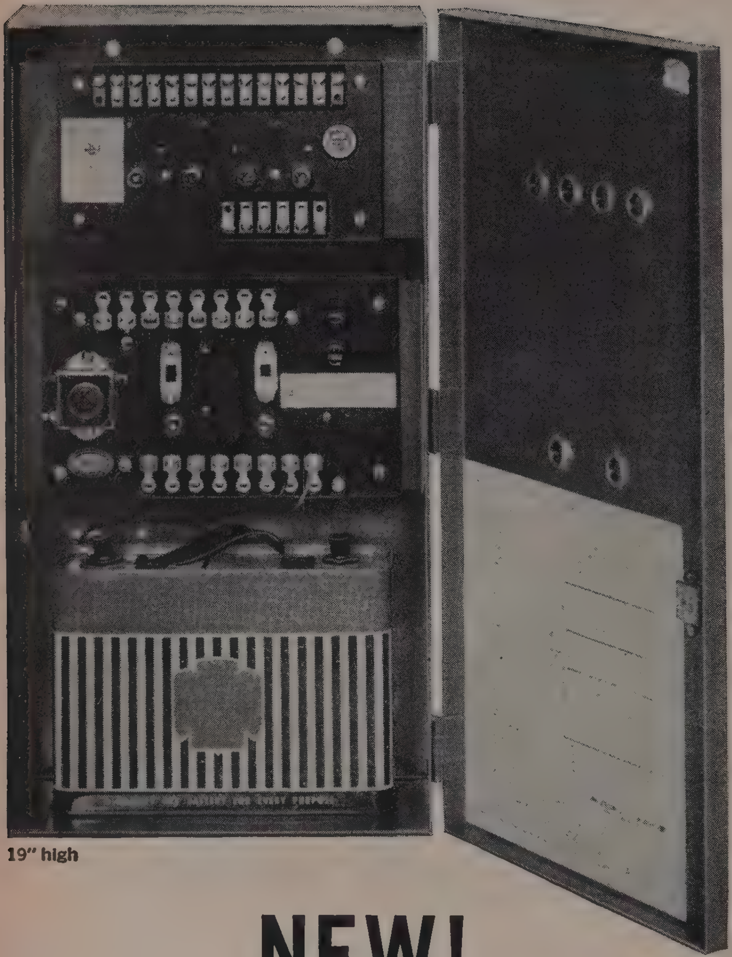
To carry a hypothetical case a



Domino luminaires — new beauty and versatility in lighting. Totally lens-enclosed, with an apparent depth of only 1½". Installs easily as a unit or in rows, for a free-flowing unbroken line of shadowless, non-glaring light. Easy to relamp. In acrylic or styrene, 2 or 4 Rapid-Start lamps. See your Smithcraft representative, or write for details:
SMITHCRAFT CORPORATION • CHELSEA 50, MASSACHUSETTS

Smithcraft

DOMINO!



19" high

NEW!

Fire Alarm Control Cabinet

Kidde's new compact automatic fire alarm combination panel monitors four circuits with local alarm. A one-circuit cabinet is also available with or without the 4-zone annunciator. Any number of detectors and noncode break-glass stations can be used with the new cabinet, and a locking-type alarm relay permits the use of self-restoring detectors or stations. The unit provides for two vibrating bell circuit terminals.

U.L.-approved, the new Kidde unit draws power from any 120 volt AC source and converts it to 6 volts DC for operation. In case of power failure, a trouble alarm sounds, and the entire system automatically transfers to self-contained battery operation. For more information, write to Kidde.

Kidde

Kidde Ultrasonic & Detection Alarms Division, 1185 Brighton Road, Clifton, N. J.
Walter Kidde & Company, Inc.

bit farther let us assume that the 1500-kva transformer has an impedance of 5¾%. The asymmetrical (including the dc component) 3-phase fault current without motor contribution is:
1500-kva trans. × 1000 watts per kva × 1.25 dc comp. mult./(0.0575 trans. Z + 0.0136 prim. Z) × 600V. × $\sqrt{3}$ = 25,300 amps.

To find the total asymmetrical fault current add five times the motor current of 1425 amps (this includes the dc component multiplier) to the asymmetrical fault current or 25,300 + (5 × 1425) = 32,425.

This is a "short-cut" method of figuring short-circuit currents, as for example to size circuit breakers. It assumes a "bolted" short circuit across the terminals of the breaker. It does not take into consideration the resistance or the reactance of feeders which if long enough could reduce the severity of the fault current depending on where the fault in the system was located. It assumes the load consists of motors and not lighting, heating or rectifiers which neither contribute to or limit the fault current. For a single-phase tap from a 3-phase system, multiply the calculated 3-phase value by 86%. The hypothetical problem was based on a secondary voltage of 600. At this voltage the interrupting duty is the same as the momentary duty i.e., the first-half cycle after the fault occurs. The multiplier used is 1.25. For voltages above 600, or where oil breakers of say the 5-kv class are used on 600-volt circuits both the momentary duty and the interrupting duty must be checked. The multiplier for interrupting duty say at 8 cycles after the fault, is taken at 1.0 instead of 1.25 as for low-voltage air circuit breakers. Momentary duty (½ cycle) multiplier is 1.5.

2) If it is assumed that there is an unlimited primary source, the impedance of the primary system is zero or there is an "infinite bus." The only impedance to the flow of current to the secondary bus would be the impedance of the transformer given in the problem as 5¾%. The total asymmetrical short-circuit current in the example was 32,425 amps. Neglecting primary impedance of .0136 the short circuit would become 38,475 amps. For additional information on the method of making short-circuit calculations, an excellent source is, "Electrical Power Distribution For Industrial Plants" published by the American Institute of Electrical Engineers, 33 W. 39th St., New York 18, N. Y.—T.M.S.

SUPERMARKETS can be converted with Norton's Automatic Door Operators to prestige entrances with a minimum of cost and traffic disturbance.

HOSPITALS can rely on Norton's Automatic Door Operators to smooth the flow of traffic in all critical areas. Installations are quick and low cost; meet all code and explosion hazard requirements.

RESTAURANTS soon find Norton's Automatic Door Operators pay for themselves. Waiters can serve more food; breakage is reduced to a minimum.

Every door offers automatic profits with Norton Automatic Door Operators

Tremendous market available; installation is easy. Norton offers good profits on sales and service of high grade automatic electric door operator kits.

Retail and commercial stores know good traffic means added profits. Hospital and service organizations must have safe and speedy traffic flow. Smooth efficient flow of traffic is demanded everywhere. Norton's surface-mounted automatic door operator meets this demand *anywhere*. It can be installed on any new or existing door. Norton's self-contained electric surface-mounted operator is the simplest, most efficient, most compact unit on the market. It's the easiest to install. Price is interesting to all potential buyers. It provides sure, dependable operation. You have a huge market, good profit volume, plus profits from service contracts after the first year warranty period. You are backed by a national advertising program.

Opportunity for Dealers—Norton, in business for 81 years, is the quality leader in door closers and automatic door operators. Norton offers a good margin to suitable dealers. A number of territories are still open. If you are interested, write, telling us about your type of business and sales organization, or mail the coupon.

NORTON DOOR CLOSERS
372 Meyer Road, Bensenville, Illinois

THOUSANDS OF USERS

Grocery Stores
Hardware Stores
Dry Cleaners
Dress Shops
Shoe Stores
Auto Supply Stores
Beauty Shops
Banks
Motels
Hotels
Clubs
Public Buildings
Offices
Clothing Stores
Restaurants
Hospitals
Drug Stores
Department Stores
Factories
Warehouses
Liquor Stores
Variety Stores
Auto Dealers
Bakeries

EASY TO INSTALL

Norton Automatic Door Operators are supplied in *kits*, with all necessary equipment and accessories. They are easy to install. All diagrams and our Installation Manual are included. Just bolt to door, install mats, connect wiring, and plug in!

1023

MAIL THIS COUPON

Norton Door Closer Company, Division of the Yale and Towne Mfg. Co., 372 Meyer Road, Bensenville, Illinois. ECM-111

Please send me information on Norton Automatic Door Operators and details on your dealer proposition

Name__________

Company__________

Address__________

City__________ State__________

Type of Business__________

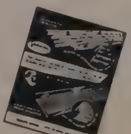
NOW···GLOBE OFFERS···
two new INTERCHANGEABLE trays
for support of cables, wiring and tubing

- ★ Engineered for uniform design and easy installation
- ★ Steel or aluminum construction
- ★ Complete accessories for SPEEDIER Installation
- ★ No sharp edges to damage cables
- ★ Complete interchangeability

Now, for the first time, two types of cable trays, one a ladder type and the other a basket type, are available to be used INTERCHANGEABLY at any given location, depending on the type and weight of the cables to be suspended. The advantages of each type tray can thus be used to the fullest extent. Globetray, the ladder type, is intended for use where festooning is not a problem, while Cable-Strut, the basket type, is intended for the support of communication wire, instrument tubing and control cables in automation applications.

These two cable trays have been thoroughly field tested in hundreds of large industrial installations, in new plant construction, in power plants, in modernization, and for power distribution in all types of manufacturing processes. A new catalog, just off the press, gives full information and installation techniques. Ask for your FREE copy today.

Distributors are to be found in all principal cities—consult the yellow pages in your phone book under "Gratings" or "Conduits" for the one nearest you.

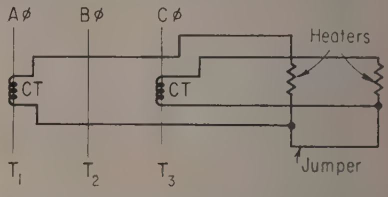


109

PRODUCTS DIVISION
The GLOBE Company MANUFACTURERS SINCE 1914
4032 SOUTH PRINCETON AVENUE, CHICAGO 9, ILLINOIS

Can You Answer These QUESTIONS?

QUESTION N40—We recently installed some across-the-line Size 5 starters which had running overcurrent protection on two legs, and this current was reduced by CT's with a ten to one ratio so a small size heater can be used. On further examination I noticed a jumper, as shown on sketch, that connected the two heaters together. No one was able to explain to me what this jumper was for. Would you please tell me why this jumper is used?—G.R.G.



QUESTION P40—In our plant we have a delta-delta ungrounded transformer bank to supply power. Since we are building an addition to our facilities, we would like to take advantage of high-voltage lighting.

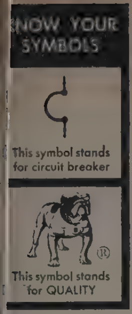
Is it possible to reconnect these transformers to 3-phase, 4-wire star, without sacrificing transformer capacity to a great extent? The three 200-kva transformers have no center taps. Primary voltage is 13,800 and secondary is 460. —S. M.

QUESTION Q40—We have several compensator auto transformer motor starters in our plant. The contacts are immersed in insulating oil. Is there a simple method which may be used to determine when oil must be replaced?—S.P.

QUESTION R40—Given a 10-hp, 230-volt, 3-phase motor, delta hook-up with incoming power open delta, two legs read approximately the same amperage and one leg is much higher.

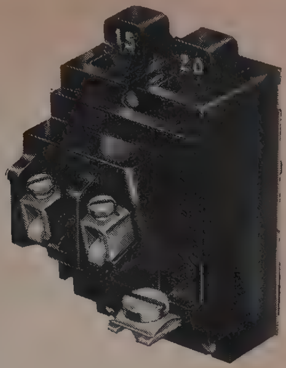
What causes this, and how can you determine if the motor is pulling proper amperage? Will a closed delta hook-up correct this and give a balanced condition?—C.W.R.

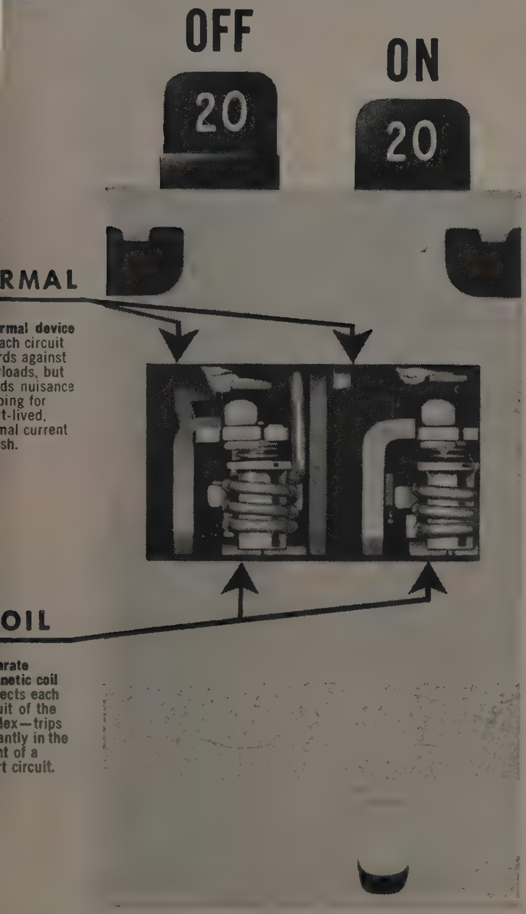
PLEASE SEND IN YOUR ANSWERS BY DECEMBER 15


NOW YOUR SYMBOLS
This symbol stands for circuit breaker
This symbol stands for QUALITY

BullDog Duplex Pushmatic—

Still the leader in residential safety and convenience!





The leader in safety . . . BullDog's Duplex Pushmatic® circuit breaker provides two protective systems in each circuit. A thermal control teams up with a magnetic coil to assure maximum protection under *any* residential operating condition and to avoid nuisance tripping. Bolted bus-bar connection assures tight, positive contact that prevents overheating. This maximum electrical safety is your best protection against costly trouble calls!

The leader in convenience . . . the Duplex Pushmatic puts two general-purpose circuits, 15 or 20 amps, in the panel space of one—provides maximum circuit flexibility with smaller, less expensive panels. And the Duplex is the *only* breaker with exclusive pushbutton convenience. Also, a tripped breaker can be identified instantly by sight or touch, resets with a push of the finger. For complete details on Pushmatic breakers and panels, write for your "Pushmatic Pocket Guide"—*it's free!*

BullDog Electric Products Division, I-T-E Circuit Breaker Company, Box 177, Detroit 32, Mich. In Canada: 80 Clayson Rd., Toronto, Ont. Export Division: 13 East 40th St., New York 16, N. Y.

I-T-E CIRCUIT BREAKER COMPANY
BULLDOG ELECTRIC PRODUCTS DIVISION

Why you should SPECIFY SEALTITE by ANACONDA

to protect electrical wiring

You know the trouble spots in plants where electrical wiring has to be protected against hazards. Perhaps you've spotted the problem as moisture . . . oil . . . vibration . . . chemical fumes . . . dust . . . corrosion. If you recommend that the wiring be enclosed in SEALTITE, then you know it's protected by the best flexible electrical wiring conduit available. Its strong galvanized steel core is protected by a tough polyvinyl chloride cover. Extreme flexibility permits installation in cramped quarters . . . and in installations that must hug contours. Easy to work with, too. Specify the original, the best. It costs no more. Available from leading electrical wholesalers. For new SEALTITE bulletin S-544, write to Anaconda Metal Hose, P.O. Box 791, Waterbury 20, Conn.

Get what you specify: The conduit you receive is Sealtite only when it's marked "Sealtite" and "Anaconda" on the cover. 61-942

SPECIFICATIONS

	Trade Size (In.)	INSIDE DIAMETER Min.	INSIDE DIAMETER Max.	OUTSIDE DIAMETER Min.	OUTSIDE DIAMETER Max.	Approx. Inside Bend Diam. (Inches)	Feet Per Std. Coil	Approx. Shipping Wgt. (Lbs.) Per Std. Coil	Feet Per Std. Reel	Approx. Shipping Wgt. (Lbs.) Per Std. Reel
TYPE UA	3/8	.484	.504	.690	.710	6	200	60	1500	460
	1/2	.622	.642	.820	.840	7	200	70	1000	365
	3/4	.820	.840	1.030	1.050	10	150	70	850	420
	1	1.041	1.066	1.290	1.315	13	100	90	600	525
	1 1/4	1.380	1.410	1.630	1.660	16	50	70	375	430
TYPE EF	3/8	.485	.505	.690	.710	4	250	60	1500	390
	1/2	.620	.640	.820	.840	5	200	60	1000	325
	3/4	.815	.835	1.030	1.050	6	175	70	850	375
	1	1.030	1.055	1.290	1.315	8	100	60	600	420
	1 1/4	1.370	1.395	1.635	1.660	9	100	80	375	360
	1 1/2	1.575	1.600	1.875	1.900	11	50	55		
	2	2.020	2.045	2.350	2.375	14	50	75		
	2 1/2	2.480	2.505	2.850	2.875	19	50	105		
	3	3.070	3.100	3.470	3.500	23	25	80		
	4	4.000	4.040	4.460	4.500	28	25	105		

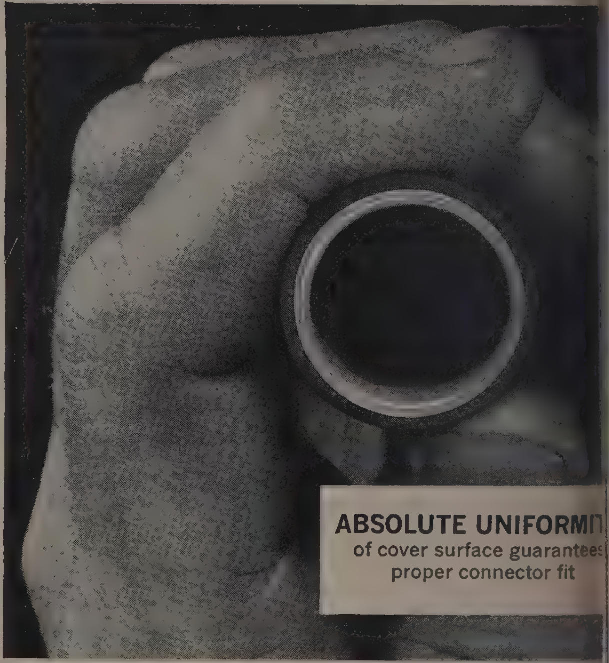
SEALTITE®

a product of

ANACONDA®

METAL HOSE DIVISION

TOUGH, GALVANIZE
STEEL CORE
offers strength and
flexibility, ease of installatio



ABSOLUTE UNIFORMI
of cover surface guarantees
proper connector fit

STANDARD CONNECTO
have been designed by leadin
manufacturers to Sealtite
specifications. They're
liquid-tight, hold securely

Questions on the Code

Answered by:

R. L. LLOYD, *Electrical Safety Engineer, National Bureau of Standards, Washington, D. C.*
B. Z. SEGALL, *Consulting Electrical Engineer, New Orleans, La.*
R. E. WARD, *Chief Electrical Inspector, Insurance Department, State of Tennessee, Nashville, Tenn.*

READERS are invited to submit questions regarding the National Electrical Code and its practical application to this Department. Questions are answered by the consulting editor whose initials appear at the end of each item. The views and opinions expressed are, in each instance, those of the individual consultant replying and are not necessarily those of his employers, of this publication or of a Code-making committee or panel on which he may serve in an official capacity.

Cold-Storage Vault Wiring

Q. *We find it is impossible to prevent moisture collecting in vapor-tight fixtures, fittings, etc. What would be wrong with using Type UF cable in cold-storage vaults with a third wire for grounding?—D.C.*

A. Both paragraphs 336-3(b) and 339-3(d) would permit wiring such as you suggest.

Paragraph 336-3(b) refers to the use of Type NMC cable in damp or corrosive locations. There are quite a few types of Type NMC cable that also show the marking of Type UF on its outer covering.

Paragraph 339-3(d) permits the use of UF cables in such locations, provided the installation is made as required for non-metallic sheathed cable, Type NMC, in Article 336.—B.Z.S.—11/61/1

Fixtures in Class I Division 2 Areas

Q. *We have a chemical storage room in which we store small closed containers (under five gallons) of flammable solvents. Under the provisions of the National Electrical Code, this is a Class I, Division 2 hazardous location. Are standard two 40-watt lamp rapid-start, fluorescent lighting fixtures acceptable for installation in this area?—J.H.K.*

A. In a Class I, Division 2 hazardous location, the rapid-start fluorescent type lighting fixture would be expected to meet the requirements of Paragraphs 501-9 (b) (2) and (3) and would, therefore, be suitable for this location. If a fixture switch is provided in the room, whether on the wall or at the fixture, its contacts shall be oil-immersed or located in a sealed chamber. A mercury-type switch can be used to meet this requirement. Although the question states the classification of the area, such a determination is the responsibility of the authority having jurisdiction rather than a requirement of the code.—R.L.L.—11/61/2

Grounding Outlet Boxes

Q. *In a residence the wiring method is non-metallic sheathed cable. The building is frame construction, brick-veneered with plastered walls and ceilings. The plaster is applied to metal lath. Both wall and ceiling boxes are metal. All fixtures and plates are of insulating material with no exposed metal within reach of a person in the residence.*

Is it a requirement that such boxes be grounded? If so, why?—M.S.

A. It is a requirement that metal boxes be grounded unless insulated from their supports and from the metal lath. Insulating metal boxes from metal lath is difficult to achieve. Section 370-4 states:

"Metallic Boxes. Where used with knob-and-tube work or non-metallic sheathed cable, and mounted on metal or metal lath ceilings or walls, such boxes shall be insulated from their supports and from the metal or metal lath, or shall be grounded."

The reason for this rule is if a breakdown occurs in an ungrounded conductor in a metal box and comes in contact with the metal box, and if the metal box is in contact with the metal lath, the lath and box will be charged. And in many cases, you would have a current flow to ground through some metal such as a vent pipe from plumbing, heating or cooking equipment if the vent pipe is in contact with the metal lath. I have personally investigated several cases similar to the above where people have received fatal shock or fires have been the result of such an installation.

Code Panel No. 5 has had numerous conditions called to its attention in line with the above, and the panel has approved and recommended that the following be made a part of the 1962 NEC in the form of a fine-print note following Paragraph 250-44(d):

"It is RECOMMENDED that all extensive metal in or on buildings, which may become energized and which is subject to personal contact, be bonded together and grounded."

The panel comment is as follows: "There was no disagreement that the original proposal as submitted by the IAEI represented an ideal bonding arrangement which would improve relative safety, but the panel was equally aware of the difficulties of administering and properly limiting such mandatory provisions. It was agreed to accept the intent of the proposal in a fine-print note."—R.E.W.—11/61/3

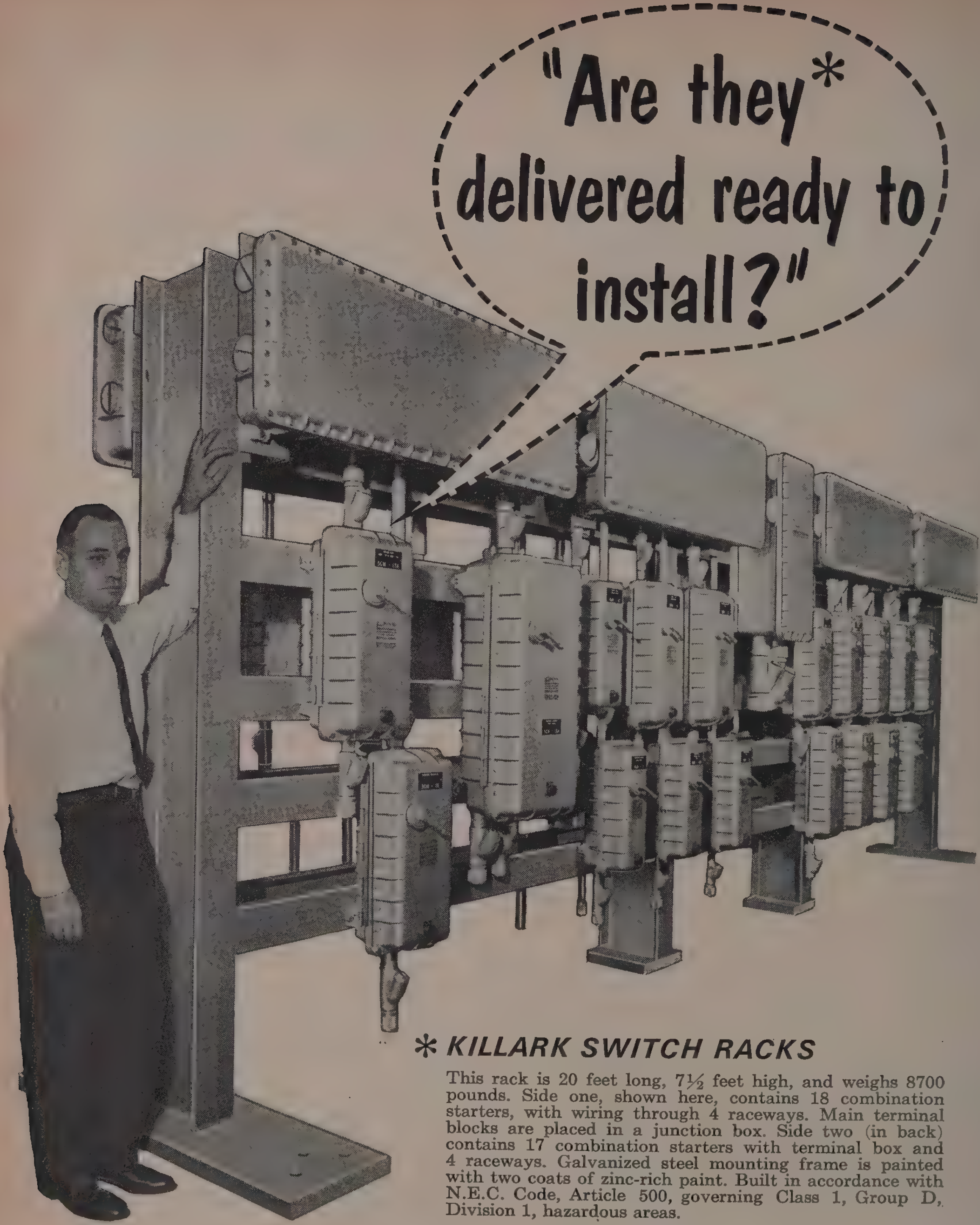
Bonding—Water Pipe Electrode

Q. *Paragraph 250-112(a) states that equipment may be grounded to a cold-water pipe near the equipment. If this is done, is it then necessary to bond around all connections likely to become disconnected, which exist between the point of attachment and the street side of the meter or point of entrance of the water service?—D.J.N.*

A. The provisions of Section 250-112 are quoted as follows:

"To Electrode. The grounding connection to the electrode shall be located as follows:

"(a) To Water Pipes. System or common grounding conductors shall be attached to a water piping system on the street side of the water meter or on a cold water pipe of adequate current-carrying capacity as near as practicable to the water service entrance to the building. Where the source of the water supply is from a driven well in the

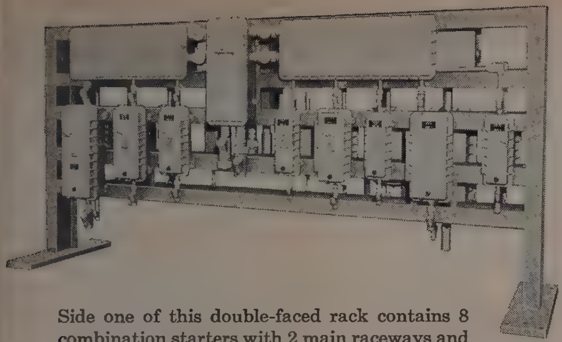


* KILLARK SWITCH RACKS

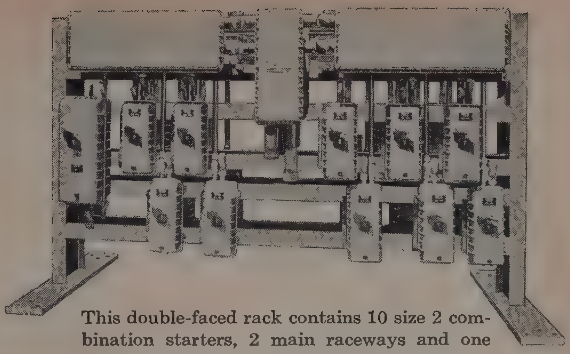
This rack is 20 feet long, 7½ feet high, and weighs 8700 pounds. Side one, shown here, contains 18 combination starters, with wiring through 4 raceways. Main terminal blocks are placed in a junction box. Side two (in back) contains 17 combination starters with terminal box and 4 raceways. Galvanized steel mounting frame is painted with two coats of zinc-rich paint. Built in accordance with N.E.C. Code, Article 500, governing Class 1, Group D, Division 1, hazardous areas.

Killark

ELECTRIC
MANUFACTURING
COMPANY

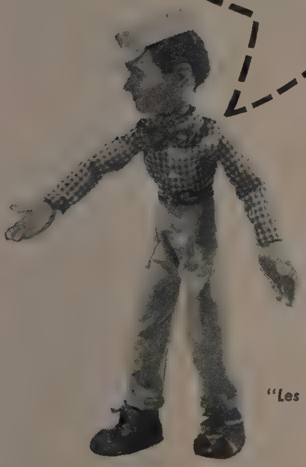


Side one of this double-faced rack contains 8 combination starters with 2 main raceways and one main terminal box. The back side contains similar equipment. Total estimated weight 4,952 pounds. Length 15′, height 7′10″.



This double-faced rack contains 10 size 2 combination starters, 2 main raceways and one main terminal box on each side. Weight 4,828 pounds, height 7′10″.

"You bet they are! Designed, assembled, wired, sealed, shipped. Ready to hook up to power."



"Les Sparks"

Killark's Bob Grimm, Assistant Sales Manager, is shown on the opposite page, by one of four (front-back) switch racks recently built for a Texas oil refinery. Two others are illustrated above.

All-aluminum control centers are custom-designed by Killark engineers from the broad selection of Killark enclosures: motor starters, disconnect switches, circuit breakers, panel boards.

Killark switch racks offer several really big advantages. Because they're aluminum, they're lightweight, rust-proof, non-sparking. They're versatile; you can specify them as large or small, as simple or complex as you require. They can be built for indoor or outdoor location, for hazardous or non-hazardous environments. All boxes are ribbed for higher strength and faster heat dissipation, rectangular for more compact assembly, front-opening for easier access and servicing.

Killark does practically all the work for you, from blueprints to assembly to wiring to sealing to shipping. The racks arrive at your plant ready to hook up to your power.

If you would like further information about Killark custom-assembled switch racks, drop us a line and we'll be happy to give you complete details.

Vandeventer and Easton Ave. St. Louis 13, Mo.

In Canada: Killark Electric of Canada, Ltd., 421 Islington Ave. South, Toronto 18, Ont.

This is the little fella

that cut starter failures by 98%

See it? That condenser up there isn't paper (the usual thing), but *ceramic*. It's in every Sylvania starter and the difference it makes in performance will surprise you.

A two-year test in one manufacturing plant showed Sylvania fluorescent starters had only 1 failure out of 340 starters. Conventional starters with paper condensers had 51 failures out of 330 starters.

Paper can't stand up as well to heat, cold, moisture. Ceramic condensers do. Another reason why Sylvania alone can give you an exclusive Certified Performance Policy *guaranteeing*: "If at any time, in your opinion, any Sylvania Fluorescent Starter fails to give satisfactory service during the 12 months from date of purchase, it may be returned to the supplier for full refund of purchase price."

Yes, Sylvania lowers your TCL (Total Cost of Lighting). That means lower cost of lamp plus power plus MAINTENANCE. Try Sylvania next time you need starters!

SYLVANIA
Subsidiary of
GENERAL TELEPHONE & ELECTRONICS

Lighting Division, Sylvania Electric Products Inc.,
Dept. 15, 60 Boston St., Salem, Mass.
In Canada: Sylvania Electric (Canada) Ltd., Montreal.

basement of the premises, the connection shall be made as near as practicable to the well. Where practicable, the point of attachment shall be accessible. Where the point of attachment is not on the street side of the water meter, the water piping system shall be made electrically continuous by bonding together all parts between the attachment and the street side of the water meter or the pipe entrance which contain insulating sections or are liable to become disconnected, as at meters, valves and service unions. Equipment may be grounded to a cold water pipe near the equipment."

This code rule only concerns the grounding connection of a "System or Common Grounding Conductor" to a water piping system electrode. As a result, the status of a grounding conductor, used for grounding equipment only, appears to be obscure in so far as bonding is concerned. As an example, a 480-volt ungrounded delta service enters a building. It consists of three 500 MCM conductors. According to Section 230-63, the service equipment must be grounded. Sections 250-71 and 250-72 cover the requirements for bonding and continuity at service equipment. Paragraph 250-94(b), including the table, gives us the minimum size of the copper wire, conduit or EMT required for grounding the service equipment for a given conductor size. I am unable, however, to find any code rule, such as Section 250-112, which concerns the continuity of a water-pipe electrode when a grounding conductor for grounding service equipment or other electrical equipment is used. While the code makes a distinction in hazard between a "common grounding conductor" and an "equipment grounding conductor," as covered by Tables 250-94(a) and 250-94(b), it appears to be that the continuity of a water-pipe electrode is very significant regardless of the type of grounding conductor involved. I believe that the first sentence of Paragraph 250-112(a) should be revised to read as follows:

"System, common grounding conductors (or service equipment grounding conductors) shall be attached, etc."

This would clarify the obscure status of a grounding conductor used only for grounding equipment.

The provisions of Paragraph 250-112 (a) appear to be woven around the service equipment, and that part of the grounding circuit between the point of attachment to the water pipe and the point where the pipe enters the building. As a result, the status of an equipment grounding conductor located remote from the service, as it concerns the continuity of the water-pipe electrode, is questionable. I believe that the last sentence of Section 250-112 should be revised to read as follows:

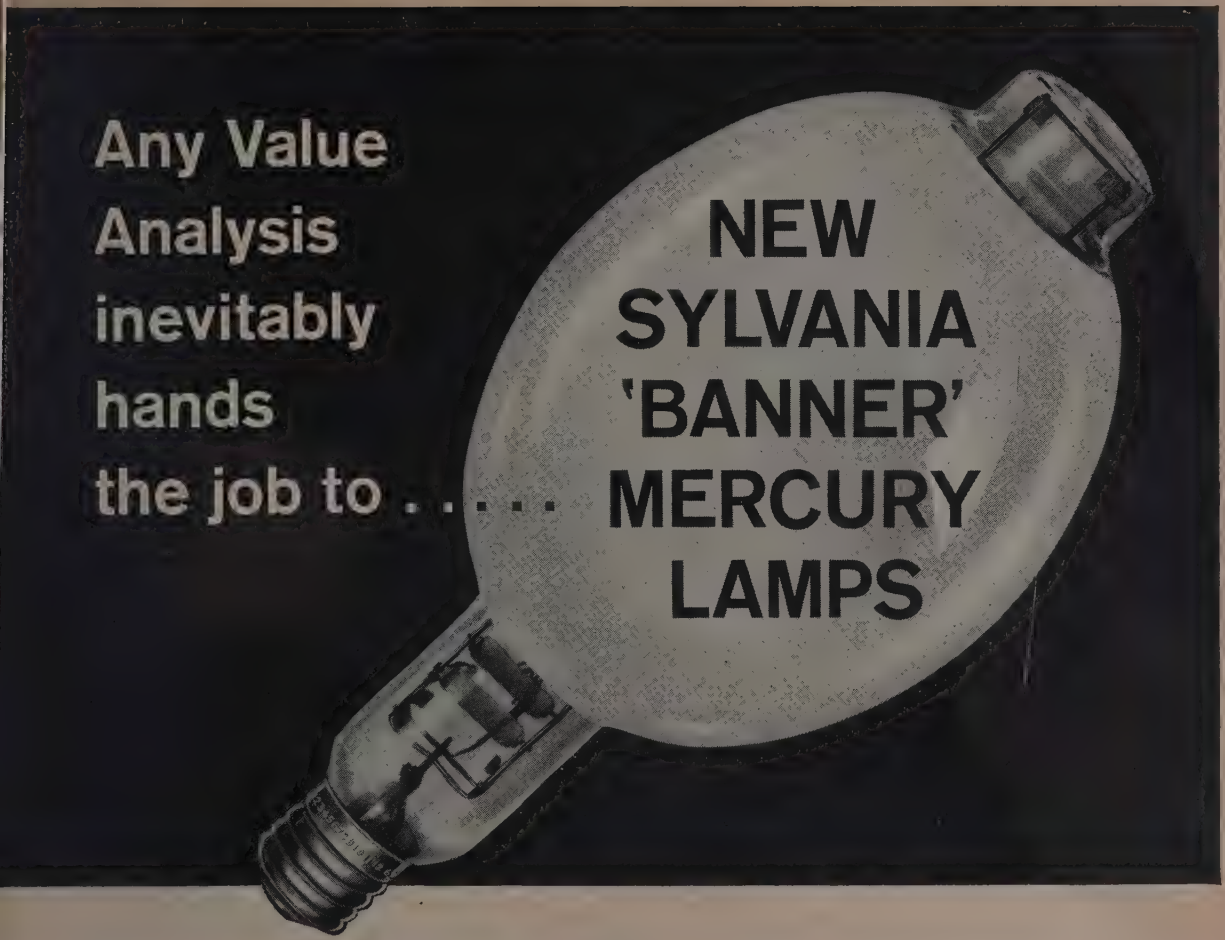
"Equipment may be grounded to a cold-water pipe near the equipment provided the above bonding requirements are satisfied." This would take care of the unions and valves common to water pipe systems. Paragraph 250-57 (b-2) recognizes the grounding of fixed equipment through a separate grounding conductor, and Paragraph 250-59 (c) also recognizes, by special permission, such procedure for portable equipment. The point that the code does not appear to cover concerns the continuity of the water-pipe electrode when equipment is grounded at a point adjacent or near to the equipment.

Regardless of the foregoing personal concept of the code rules involved and discussed, I would not hesitate to advise that all connections likely to become disconnected, which exist between the point of attachment and the street side of the meter, should be bonded. The personal-injury hazard involved is serious, and should not be discounted regardless of the literal reading of a code rule.—B.A.McD.—11/61/4

Fire Alarm Systems

Q. *Recently I turned down a fire alarm installation in a school building where the contractor had installed the detector circuits in the same conduit as the exit light circuits. I contend this was a violation of Section 700-17 of the NEC. I also believe it is a violation of Section 725-16 (last sentence) as the only classification of a fire alarm system I can find is contained in NFPA Bulletin No. 72, Section 2141, which states that this system is a Class 1 signal system and subject to the provisions of Article 725 of the NEC regarding Class 1 systems.*

The question has been raised that a fire alarm system is an emergency system since it is taken off the supply side of the service disconnecting means and therefore as such can be run with the exit light circuits as it is one and the same system, subject to insulation being suitable for the highest voltage.



because only Sylvania offers all these advantages:

1. Longer life—now extended from 9,000 to 12,000 hours (that's about 3 years of continuous service in a 2-shift plant!), thanks to new trimetallic electrodes.

2. More light—approximately 2 to 3 times the light of incandescents on the same power! You get more light output initially, higher maintained light, too.

3. Ruggedized construction. Banner lamps stand up to fiercest punishment. From hard glass shell to solidly welded, multiple-supported innards, they shake off shock, vibration, weather.

4. Life Recording Base—unusual feature saves precious time, annoying paper work by letting you scratch installation date in code right on the base of the lamp.

5. Certified Performance Policy—guarantees that: "Banner Mercury Lamps may be returned to the supplier for full exchange if they fail in less than 1000 burning hours, and thereafter (up to 5000 hours) for pro-rata exchange, in accordance with a pro-rata exchange value table set forth clearly in the policy form."

PLUS Lowest TCL (Total Cost of Lighting), which means cost of lamps plus power plus maintenance. Sylvania assures you of lower costs all the way!

Lighting Division, Sylvania Electric Products Inc., Dept. 15, 60 Boston St., Salem, Mass. In Canada: Sylvania Electric (Canada) Ltd., Montreal.

SYLVANIA

SUBSIDIARY OF

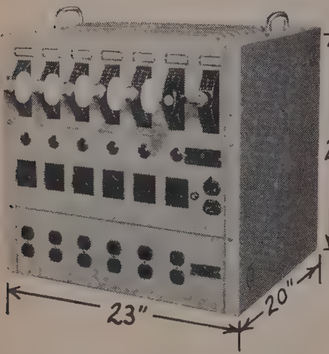
GENERAL TELEPHONE & ELECTRONICS

GENERAL SYSTEM

NEW!

CONTROLETTE®

lighting control



Here's a new, complete "packaged" lighting controller that gives your customers "most for the least."

It's Ward Leonard's CONTROLETTE . . . modern, functional, flexible, ideal for churches, schools, small TV studios, local theatres, restaurants, stores . . . any application except those requiring relatively complex switchboards.

Available in sizes of 3, 4, and 6 units at 2500 watts each giving system capacities of 7,500, 10,000, and 15,000 watts respectively . . . plus a new three-unit CONTROLETTE rated at 6,600 watts each for a total of 19,800 watts!

Here are just a few of CONTROLETTE's most outstanding features: • Compact, portable • Low in cost • Smooth, close control • Circuit completely protected • Easy to install, easy to operate • Equipped with "master" and interlocks for grouping • Highly flexible in application.

Write for full details. Ward Leonard Electric Co., 28 South Street, Mount Vernon, New York.

2.7

RESULT-ENGINEERED CONTROLS
WARD LEONARD
ELECTRIC CO. MOUNT VERNON NEW YORK
RESISTORS • RHEOSTATS • RELAYS • CONTROLS • DIMMERS

If this is the case, the main switch for the fire alarm circuits could be installed in the emergency panel with the exit lights as the systems are the same classification.

I have been requiring a separate disconnecting means, separate from the exit light panel and requiring that it be identified by means of painting red, and having suitable lettering identifying it as fire alarm.

Please give me your opinion. Am I right in classifying the fire alarm system as a Class 1 signal system and insisting that it be separated from the emergency circuits, or are the two systems so closely allied that they could be considered as emergency circuits and subject only to Article 700.—J.A.R.

A. For the convenience of our readers, the provisions of Section 700-17 covering emergency systems are quoted as follows:

"700-17. Independent Wiring. Emergency circuit wiring shall be kept entirely independent of all other wiring and equipment and shall not enter the same raceway, box or cabinet with other wiring except:

"Exception No. 1. In transfer switches.

"Exception No. 2. In exit or emergency lighting fixtures supplied from two sources."

This rule first appeared in the 1933 edition of the code, and at that time the exception for transfer switches was not recognized. Such recognition was delayed up until the 1953 Code. Reference to the scope of emergency systems, as covered by Section 700-1, indicates that such systems are provided solely for the purpose of supplying illumination and power in the event of failure of the normal supply, or in the event of accident to elements of a system supplying power and illumination essential for safety to life and property. The function of a fire alarm is entirely different. While a fire alarm signal may indicate an emergency, in the form of a fire, it is in no way concerned with providing light and power to the building. It is a signal of significant importance which should function as intended —when a fire occurs. The significance may be realized after a casual review of NFPA Standards 71, 72 and 73, covering signaling systems.

In view of the foregoing, your criticism of the installation described in your question, is justified on the basis of Sections 700-1 and 700-17. An emergency system for light and power may prove to be more important than a fire alarm system, since it tends to safeguard a hazard which concerns personal injury and life. A fire alarm system primarily is concerned with property damage; but it may, particularly in a school occupancy, safeguard people from the hazards of fire. Both systems should be isolated one from the other, so that any electrical defect on one system will not involve the other. So that the maintenance of one system will not affect adversely the operation of the other, such as an interruption of service, due to an inadvertent act of the electrician.

According to the index of the code, fire-alarms are listed as subject to the provisions of Article 800 covering communication circuits. Reference to Section 800-1 indicates that its scope only concerns fire alarm systems which are a part of a central station system. A communication circuit is defined by the code as follows:

"A circuit which is part of a so-called central station system." The following fine print note is taken from the definition:

"Such circuits include telephone, telegraph, fire and burglar alarms, watchmen, and sprinkler supervisory circuits."

While the provisions of Paragraph 800-3(a-2) prohibit central-station alarm system conductors to be placed in the same raceway with power and light circuits, there could be a question with respect to its application to a local system, or one which is supervised at the property protected. Since the fineprint note following Section 800-1 refers us to the standards of NFPA for the details involved. Article 440 of NFPA Standard No. 72 covers local systems. Assuming this to be the proper classification for the school under discussion, one finds that the provisions of Chapter 2, covering proprietary signaling systems, also apply to local systems. As a result, the provisions of Section 2141 of NFPA Standard No. 72 are quoted as follows and appear to apply:

"All inside wiring shall be in conformity with the requirements of the National Electrical Code for Class 1 signal systems except as otherwise indicated in this Article, or other Articles of this standard."

Reference to Section 2160 of the NFPA standard indicates when the voltage is limited to 50 volts and the current is limited to 100-volt amps, the use of a Class 2 circuit appears to be recognized. As a result, a signal circuit such as a

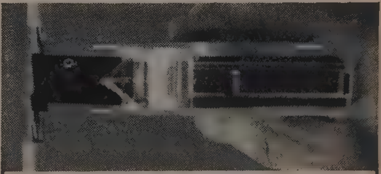
Fast, easy to handle...even overhead!

J-M DUTCH BRAND PLASTIC ELECTRICAL TAPE IN THE BRAND-NEW DISPENSER makes taping faster, easier than ever. Here's why:

FAST, EASY-TO-USE DISPENSER gives you ten important advantages. And—because this new Dutch Brand dispenser helps electricians "tape and tear" in one simple operation—a better-looking, longer-lasting job is assured.

STRONG, DEPENDABLE TAPE is thin and flexible . . . meets the industry's highest standards. What's more, J-M Dutch Brand Plastic Electrical Tape has uniformly high dielectric strength . . . provides outstanding resistance to acids, alkalies, oil, solvents, fungus, bacteria and gases. In short, *the finest plastic electrical tape you can buy carries the Dutch Brand name.*

SEE FOR YOURSELF! Get all the facts on dependable J-M Dutch Brand® Plastic Electrical Tape in the handy new dispenser from your Dutch Brand distributor. Or write Dutch Brand Division, Johns-Manville, Box 359, New York 16, N. Y. In Canada: Port Credit, Ont. Cable: Johnmanvil.



TEN IMPORTANT ADVANTAGES!

1. Permanently shielded cutter! **2.** No moving parts to snag hands, clothes! **3.** Can't dull or clog! **4.** "Tape-and-tear" with one hand! **5.** Special "grip-strip" for faster starting! **6.** Full 66′ of finest plastic electrical tape made! **7.** Preloaded . . . ready to go! **8.** Protects tape against dirt, grease! **9.** Big center hole for easy handling! **10.** No extra cost!

JOHNS-MANVILLE
DUTCH BRAND TAPE

JOHNS-MANVILLE JM PRODUCTS

JET SET

makes short work of wiring small conduit!

Handy JET SET gives you everything needed to wire any length 1/2″, 3/4″, or 1″ I. D. conduit—and do it faster, safer, for less cost!

JET SET includes: Rigid Rope (for fishing short runs); Jet Line Cylinder (for putting a line through longer runs in seconds), and Poly Rope and Reel (strong and safe for long pulls). All this in a compact, easy-to-carry unit that weighs under 30 pounds!

For every crew, every truck, get JET SET—the most important tool you can carry—*and go!* Write for full information on how JET SET (and the entire Jet Line Method*) can cut your conduit wiring costs up to 70 per cent!

**Patents cover entire Jet Line Method and apparatus*

JET LINE® PRODUCTS, INC.
305 Foster Ave.
Charlotte 3, N. C.
5023

fire alarm may be either a Class 1 or a Class 2 circuit, depending upon the electrical characteristics of the circuit. According to the provisions of NEC Section 725-16, signal conductors which are classified as Class 2 systems, but are insulated as required for Class 1 systems, are considered to be Class I system conductors. Under such circumstances the power supply conductors serving the signal system may be installed in the same enclosure or raceway with the Class 1 of Class 2 conductors. This does not cover power or light circuits foreign to the signal circuit or emergency lighting circuits. It is significant to note the general provisions of Section 300-3 (e) which definitely state that conductors of signal systems shall not occupy the same enclosure with conductors of light and power systems except as permitted for signal circuits in Section 725-16.

In view of the foregoing, it appears obvious, on the basis of Sections 700-1, 700-17, 725-16 and 300-3, that the installation described in your letter does not satisfy code requirements. It appears to me, however, that the status of a local or proprietary fire alarm system should be clarified under Section 800-1, and that the index of the code should be supplemented to cover such alarm systems. Possibly the definition of a signal circuit should be supplemented to include fire alarm circuits.—B.A.McD.—11/61/5

Feeder Calculations

Q. *On a low-rent housing project, the service entrance consists of three No. 6 TW insulated wires in 1-in. conduit with a 60-amp, weatherproof, fused service switch located directly under the metering equipment. The total calculated load in the building is 27 amps not taking any diversity factor from the calculated load.*

Does the code require the feeder from the outside weatherproof switch to be three No. 6's in 1-in. conduit, or can conductors be installed of a smaller size that will carry the calculated load?—G.H.

A. Your question is answered in Section 215-2, which reads as follows:

"Feeder conductors shall have a current rating not smaller than the feeder load as determined by Section 220-4. A 2-wire feeder supplying two or more 2-wire branch circuits, or a 3-wire feeder supplying more than two 2-wire branch circuits, or two or more 3-wire branch circuits, shall not be smaller than No. 10. Where a feeder carries the total current supplied by the service-entrance conductors, such feeder, for services of No. 8 and smaller, shall be of the same size as the service-entrance conductors.

"Where at any time it is found that feeder conductors are, or will be, overloaded, the feeder conductors shall be increased in capacity to accommodate the actual load served."

You will note from the above that where a feeder carries the total current supplied by the service-entrance conductors, such a feeder for services of No. 8 and smaller shall be of the same size as the service-entrance conductors. Therefore, I would consider that a No. 8 feeder would be the minimum allowable. To answer your question, I feel that No. 8 conductors would meet code requirements for the feeder extending from the weatherproof 60-amp service-entrance switch equipped with fuses of not over 40-amps.

Although the code would not require the conduit run from the outside weatherproof switch to the panel to be larger than ¾ in., I would give serious consideration to additional load that might be added in the future, which would require a change of the feeder conductors as is mentioned is the latter part of Section 215-A. The initial cost of 1-in. conduit vs ¾-in. conduit will be minor compared to the cost of changing the size conduit after the installation is completed.—R.E.W.—11/61/6

Minimum Size Service-Entrance Conductors

Q. *Where two 20-amp 2-wire branch circuits supply exit lighting, what is the minimum size of service-entrance conductors required for this emergency lighting service?—L.F.B.*

A. The minimum size service-entrance conductors for the situation you have described can be found by referring to Exception No. 2 of Paragraph 230-41, which reads: "For installations consisting of not more than two 2-wire branch circuits they (the service-entrance conductors) shall not be smaller than No. 8." — R.L.L. — 11/61/7

SpaceMaker is an Allis-Chalmers trademark.

the only real drawout 2- to 5-kv controller...with a contactor you can get at, into, around...without tools

▲ This means no unbolting—no wires to unfasten. You rack the contactor to "disconnect position" with the door closed. Open door. Roll contactor carriage out. It's that simple, that quick . . . and safe. ● Inspection? Lift out arc chutes and barriers. Rotate pole pieces to fully expose contact structure. Fuses? Lift them out, too. No tools, all the way. ■ SPACEMAKER control. First dramatic new achievement in high-voltage motor control in more than a decade. To learn more about the many cost-cutting features, call your A-C distributor or representative. Or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

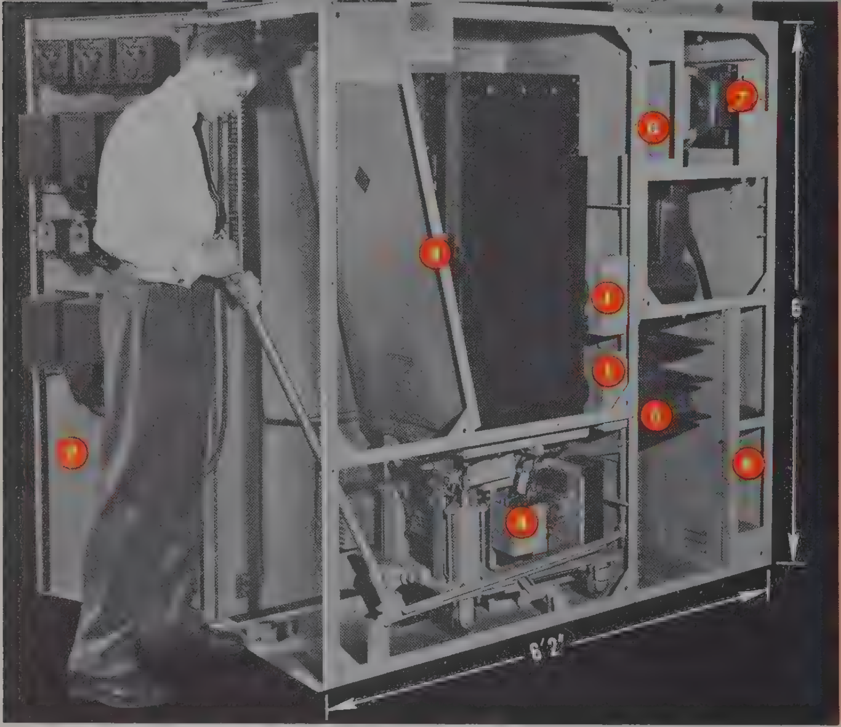
LET'S COMPARE THESE FEATURES

	SpaceMaker Controller	Controller "A"	Controller "B"
Two starters in 90" height	Yes	No	No
Drawout construction	Complete	Partial	No
Simultaneously disconnects all six main leads (line and load)	Yes	Line Only	Line Only
Automatic shutters isolate line	Yes	Yes	No
"No-tool" inspection of contacts	Yes	No	No
Track-resistant, flame-retardant insulation	Yes	No	No
Contactor construction	Double Break	Single Break	Single Break
Overload relays visible from outside	Yes	No	No

ALLIS-CHALMERS

A-1521

ALLIS-CHALMERS



▲ 4.16 kv metal-clad equipment serving a west coast city.

1. Separate compartments for current transformers.
2. Full panel metering and relaying.
3. Double-lock panel for operator safety.
4. Easy service accessibility without dismantling.
5. Glass polyester insulation throughout.
6. Separate up-feed and down-feed cable compartments.
7. Fully cast, trunnion-mounted potential transformers.

Lowest height, easiest access

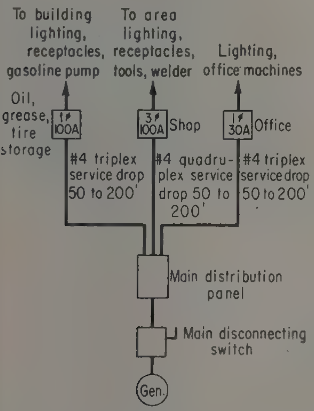
the only switchgear with fully isolated current transformers

The front-accessible current transformers can be inspected, maintained or replaced without exposure to any high voltage compartment. A-C metal-clad units are just 72 inches high — means eye-level instrumentation . . . shoulder-height accessibility of component parts. And the entire panel can be used for meters and relays. Maximum compartmentation and dead-front construction offer greater safety. Buswork and components arranged for easy addition of future units.

You get rapid, one-stroke insertion of the circuit breaker. The breaker has glass polyester insulation for highest impulse strength . . . the only self-locking protective barrier . . . four-bar linkage is mechanically, electrically trip-free. Primary disconnect fingers eliminate use of garter springs, and are on the circuit breaker for easy inspection. Both stored energy and solenoid operators are available. *For more switchgear information contact your nearby* **Allis-Chalmers** *office.* A-1457

Grounding Isolated Systems

Q. Our office administers heavy-construction contracts, many of which are in remote areas not served by commercial electric power. Consequently, the contractor supplies his own electrical energy from an engine generator set which, under the contract requirements, is to be installed in accordance with the NEC. A typical installation is shown in the sketch below.


To building lighting, receptacles, gasoline pump
To area lighting, receptacles, tools, welder
Lighting, office machines
Oil, grease, tire storage
1ø 100A
3ø 100A
Shop
1ø 30A
Office
#4 triplex service drop 50 to 200'
#4 quadruplex service drop 50 to 200'
#4 triplex service drop 50 to 200'
Main distribution panel
Main disconnecting switch
Gen.

The question is this: For an installation as shown in the sketch, is it sufficient to ground the neutral conductor at the main switch or should the neutral conductor be grounded at each branch panel location in addition to being grounded at the main switch?—L.E.F.

A. According to the provisions of Section 250-26 of the code, the location of the grounding connection for an isolated system is quoted as follows:

"For an interior wiring system or circuit which is required to be grounded and which is not electrically connected to an exterior secondary distribution system, the grounding connection shall be made at the transformer, generator, or other source of supply, or at the switchboard, on the supply side of the first switch controlling the system. See fine print note after Section 200-3."

This code rule stems from a similar rule which first appeared in the 1933 Code. It is significant to note the phrase "electrically connected to an exterior secondary distribution system," and the fine print note after Section 200-3 states: "Electrical connection implies connection capable of carrying current as distinguished from connection through electromagnetic induction".

It appears quite evident, from the foregoing, that a secondary service obtained through a transformer connected to an outside source of distribution is considered to be an isolated system. This opinion may be verified by reference to Abbott's NE Code Handbook which illustrates this rule. This illustration goes back as far as 1933, when Abbott's second edition was published. Regardless of this classification, all of the pertinent grounding rules of Article 250 apply to an isolated system, and this is self-evident from the numerous service installations which have been made since 1933, and continue to be installed today. The same logic applies to an isolated system derived from a generator.

According to your illustration, we have three distinct buildings served through an isolated system derived from a generator. Assuming that the system requires grounding, it must be grounded at the generator or switchboard as covered by Section 250-26. This grounded conductor also must be grounded at each one of the three buildings served to satisfy Section 250-24, which reads:

"Two or More Buildings Supplied by a Single Service. Where more than one building is supplied by the same service, the grounded circuit conductor of the wiring system of any building utilizing one branch circuit supplied from such service may be connected to a grounding electrode at such building, and in the case of any building housing equipment required to be grounded or utilizing two or more branch circuits supplied from such service, and in the case of a building housing live stock, shall be so connected."

This code rule, coupled with Section 250-52, which covers a common grounding conductor, provides a grounding circuit of low impedance.—B.A.McD.—11/61/8

Lightning Protection

Q. Reference is made to NFPA publication No. 78 "Code for Protection Against Lightning" Section 219(b) "The structural steel framework of a building may be utilized as the main conductor of a lightning protection system provided it is electrically continuous or is made electrically continuous by bonding of non-electrically continuous sections."

I would like to have a specific definition of the words "bonding" and "electrically continuous."

A discussion originated when using the vertical steel columns, in a 20-story building as down conductors for a lightning protection system. All vertical columns have milled ends. Some engineers believe this is a satisfactory installation. Being quite familiar with the carelessness of construction personnel, I am wondering if such joints are electrically satisfactory, or if bonding cables should be installed across these milled ends?—C.C.K.

A. In the assembly of structural steel for a steel framed building, it is common practice to use rivets, bolts, or welding as the method of fastening. Any of these methods have been found to provide adequate conductivity between the steel structural members. Where other methods of fastening are used, conductivity can be determined by measuring the resistance between the top and bottom of the structure. The terms "bonding" and "electrically continuance" can be considered to mean having an electrical resistance comparable to that of the required down conductor.—R.L.L.—11/61/9

Grounding Plugs

Q. Could the UL be asked to require 3-wire plugs on kitchen appliances?

Why put grounding receptacles in kitchen with nothing to plug into it?—W.J.G.

A. UL will require in its standards anything that is compatible with the code. At such time as the code sees fit to require the use of grounding-type attachment caps on kitchen appliances, UL will set up its standards to make the use of such caps mandatory.

It should be noted that, for the first time, the 1959 Code specifically lists equipment for use in residential occupancies in which equipment must have provisions for grounding the exposed noncurrent-carrying metal parts of portable equipment. See Paragraph 250-45(c).

The 1956 Code, for the first time, required that room air conditioners be properly grounded.

All these code requirements have reflected and will reflect themselves in the correlated requirements of the UL standards, so that more and more portable equipment to be used in residential occupancies will be required to have grounding-type attachment caps to fit into the code requirements for grounding-type receptacle outlets. — B.Z.S.—11/61/10

In the News

NECA Convention Studies Management Tools

Modern management methods, practices and services for electrical contractors was central theme of NECA's annual convention in Washington, D. C., October 10-14. Webster re-elected president.

THE 60th annual convention of the National Electrical Contractors Association was held October 10 to 14 at the Sheraton Park Hotel in Washington, D. C., with an attendance estimated at over 2200.

Harold A. Webster, president, said "NECA has selected for its theme the slogan: 'Tools for Building.' This is very appropriate for we have been building our industry for the past 60 years and we have accomplished a great deal. We must continue to build even more intensely and constructively than ever for we are twice blessed by being one of the economy's key growth industries.

"Since the last Convention there has been in numerous quarters an exhibition of the trend toward bigness which more accurately can be described as the trend toward integration in business as opposed to specialization. Perhaps the greatest threat to our individual liberties and our free economy," he said, "is the formidable combine that is resulting from the joining together of a vast military organization and the big business units that are the principal suppliers of our incredibly costly defense system.

"We have in such a situation the seeds of destruction of our free enterprise system. These big business unit suppliers do most of their business on a cost-plus fee basis or some similar setup where the government pays the costs and the companies are paid a fee. There is almost totally lacking the incentive for superior performance and production such as motivates the 'hard-money' contractors.

"Ours is a specialty industry, developed by economic need to perform a highly specialized task in the economy. Through the years we have defended our specialty, promoted it, and sold it.

"The primary purpose of this Convention," Mr. Webster said, "is to present to, explain to and then exhort electrical contractors to make use of the many tools that this industry, through cooperative pooling over more than half a century, has provided and has made available to them.

"Essentially these are management aids—aids in the complex field of public relations, marketing, labor relations, technical and training. Our industry is noted for its engineering and practical installation capabilities and its pool of skilled craftsmen. The huge and rapid expansion of the business opportunities has outspaced our growth in management capabilities and that is why we are so intently concerned with providing those tools that will build up this most vital element needed to serve our customers well.

"Actually these are not only tools for building our industry to a higher stature but, indeed, are tools for survival of our businesses and our specialist industry in this period of bigness and economic integration," Mr. Webster concluded.

Awards

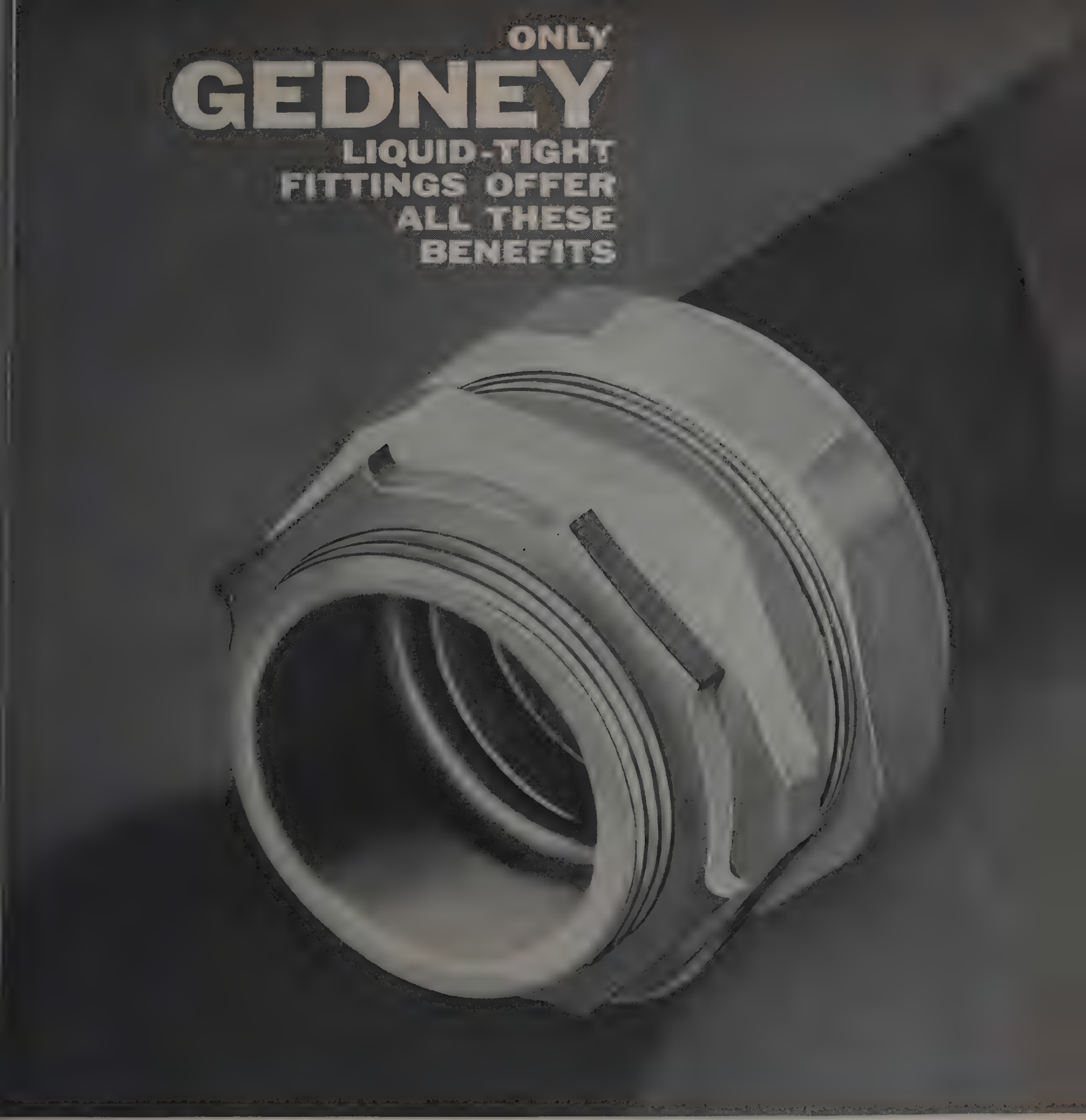
Three awards were presented by Harold A. Webster, president. They were the Coggeshall Award to Milton R. Minto, MacNutt Electric Co., New York City, for his contribution to formulation of a national accident prevention program; the Comstock Award to John S. Clark, Reynolds Electric & Engineering Co., Inc., Santa Fe, N. M., for his efforts to bring to the attention of Government agencies and awarding authorities in the missile program the benefits offered by the services of the independent specialty construction contractors; and the James H. McGraw Award Contractors Medal to Charles W. Moseley, R. H. Bouligny, Inc., Charlotte, N. C., for his dedicated leadership and diligent personal efforts toward planning and promoting the organization of line construction contractors in effective regional chapters.

Harold A. Webster, president, NECA, presents McGraw award to Charles W. Moseley, R. H. Bouligny, Inc., Charlotte, N. C.

Freedom's Challenge

Ronald Reagan, prominent motion picture actor and host of the General Electric Theater on television, delivered an address entitled "Losing Freedom by Installments." Mr. Reagan reviewed the world conflict in which the communist ideology is pitted against the free social and economic system of our country. He pointed up the intensity of the enemies' drive against our most cherished institutions and concepts and warned against our participation in the campaign toward socialism and eventual communism in our own country. He urged all to foster a healthy concern over our present plight, to resist persistent encroachments of expanding, engulfing government in the lives of free people and to return to the industrious, and self-reliant characteristics of the free men who founded and built our country. Some of the pointed phrases of his address are as follows:

"Carefully, with great calculation, the communists gauge their aggression—slicing each new gain just thin enough so that we'll say,



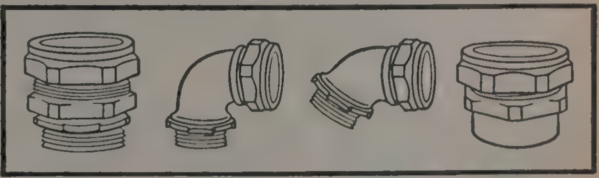
MAXIMUM PULLOUT. Extensive lab testing has proved conclusively that Gedney Liquid-Tight Fittings equal or exceed the breaking point of liquid-tight conduit…connections start tight and stay tight through extra years of service life.

RE-USABILITY. Gedney Liquid-Tight Fittings can be used again and again without destroying the *brass* grounding ferrule …the liquid-tight conduit is never damaged or made unserviceable in any way.

POSITIVE SEAL. Even the highest viscosity lubricants, oils or other liquids cannot penetrate the never-hardening vinyl sealing ring. The seal also effectively bars chemicals, fumes, dust and other foreign matter…Gedney Liquid-Tight Fittings perform better, longer, more reliably.

WIDE RANGE OF SIZES. Straight and 90° fittings from ⅜ in. through 4 in.–45° through 2 in.–combination rigid to liquid-tight from ½ in. to 1 in.

INSULATED THROAT. Available in sizes ½ in. through 2 in.



INDESTRUCTIBLE MALLEABLE IRON. Heavily plated …the toughest metal known for fittings. Offers highest thread strength. Resists sharp blows and vibration.

When you can't take a chance on quality, specify GEDNEY Liquid-Tight Fittings. They're the finest you can buy. For descriptive literature, write or call:

GEDNEY

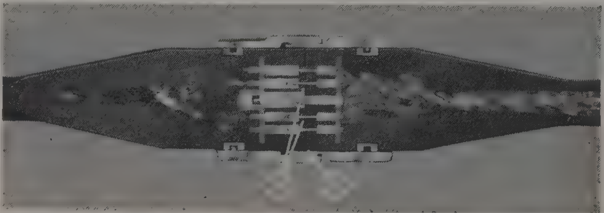
GEDNEY ELECTRIC COMPANY, INC.
1270 Sixth Ave., Radio City, N.Y. 20
Foundry, factory and shipping point:
Terryville, Conn.

TREAT 'EM ROUGH! . . . but count on complete reliability from Joy electrical connectors

Many connectors handle "garden variety" jobs, but none can take rough, tough daily abuse like Joy. They're deliberately designed to stand up under the most severe conditions, electrically and mechanically.

Molded-to-cable in resilient Neoprene, Joy connectors harmlessly absorb shock, vibration, impact, distortion . . . and remain performance perfect. In undersea applications, they remain watertight. In oil wells, they withstand pressures at 20,000 psi. They carry voltages over 7500.

In short, Joy connectors save you money through longer life, less downtime, fewer repairs.



Watertight feature is standard with Joy
Cross-section shows 26-pole engaged connector. Note (1) contact "cork" seals on every conductor, and (2) integrally molded "O" ring face seal.

CD1116.3

WRITE TODAY for BULLETIN B78

JOY

Electrical Products Division

1231 Macklind Ave. St. Louis, Mo.
Exec. Offices, Henry W. Oliver Bldg. Pgh., Pa.

G. G. Carter, Jr., Standard Electric Co., Jacksonville, Fla.; Rudy Baacke, Standard Electric Co., Jacksonville, Fla.

'That isn't worth fighting for.' They predict that when we reach the final slice our surrender will be voluntary because we will have been weakened from within—morally, spiritually, and economically.

"They have harnessed the fear of war instead of war itself—knowing that surrender at the conference table can be just as complete as surrender on the battlefield.

"Mr. Krushchev has said that capitalism will inevitably evolve into communism, but not all at once. He says there will first come an intermediate stage of socialism.

"The liberal campaigns for more and more participation by the federal government in areas heretofore the province of the state, community and individual. The only common denominator needed to win their support of any legislation is the extent to which it will increase the power and authority of the central government. We can lose our freedom all at once by succumbing to Russian aggression, or we can lose it gradually by installments—the end result is slavery.

"Our defense against communism is individual freedom and our free economy. Under high-flown phrases—'freedom from want,' 'human rights'—we see the federal government laying its hand on housing, health, farming industry and education.

"Creating bureaucracy here and in the receiving nations we have, in effect, exported socialism under the Utopian ideal of world democracy and social revolution. We talk private enterprise at home, while we finance nationalization of industry all over the world.

"All of this vast government complex has been created by a tax system which refuses to recognize any limitations on its right to confiscate the earnings of its citizens.

"We must do more than just stop spending measures. Containment won't save freedom on the home front any more than it can stop Russian aggression on the world

A Packaged Direct Mail Campaign for Electrical Contractors
"THE BEST IDEA YET FOR SELLING MORE HOUSEPOWER JOBS"

TV star
DOROTHY COLLINS
endorses
Full HOUSEPOWER
sponsored by the
National Wiring Bureau.

New Packaged Direct Mail Boosts Rewiring Business

Direct mail goes direct to the homeowners you want to sell . . . delivers your selling messages to your best prospects.

This new packaged program requires none of your time . . . all the details are handled for you automatically. Includes six colorful mailings, personalized for you, with built-in prospect locater. Costs only pennies per prospect.

NATIONAL WIRING BUREAU • A SPONSOR OF

HOUSEPOWER

Send in coupon below for complete information

National Wiring Bureau
155 East 44 Street
New York 17, N.Y.

Please send me full particulars on the new Packaged Direct Mail Campaign for electrical contractors. No obligation, of course.

*Name*____________________

*Company*____________________

*Address*____________________

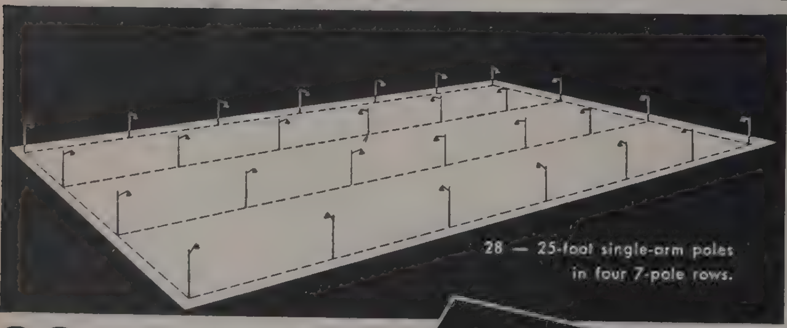
*City*__________ *Zone*_____ *State*________

ECM-11

NOW...
THOMPSON
presents lighting efficiency with built-in savings!

8 — 50-foot three-arm poles located on lot perimeter.

8 50-FT. servisafe POLES OUT PERFORM



28 25-FT. UNITS!

check THESE OUTSTANDING SAVINGS!

Safer, more efficient outdoor illumination is now possible at greatly reduced installed-cost. Lights mounted on 50-ft. poles cover more than three-times the area covered by those on 25-ft. units. And . . . there's no need to invest in trucks and telescopic carriers because maintenance men can disconnect and lower fixtures for servicing in complete safety with both feet on the ground.

- ✓ BETTER OVERALL LIGHTING
- ✓ LOWER INSTALLATION COSTS
- ✓ 50% LESS TRENCHING
- ✓ 50% LESS WIRING
- ✓ NO AREA OBSTRUCTIONS
- ✓ BETTER APPEARANCE
- ✓ LESS GLARE
- ✓ EASY MAINTENANCE
- ✓ INCREASED SAFETY

T-E THE THOMPSON ELECTRIC COMPANY
P. O. Box 873-D • Cleveland 22, Ohio

Request the full story... specifications . . . costs and installation details.

William F. Byrd, Harvill-Byrd Electric Co., Little Rock, Ark.; William E. Walter, Fort Pitt Electric Construction Co., Pittsburgh, Pa.

front. We must roll back the network of encroaching controls. We can do it as individuals—we won't need any great new organization.

"Now you and I must answer once again whether life is so dear and peace so sweet as to be purchased at the price of chains and slavery. If we are unwilling to pledge our lives, our efforts and our sacred honor, then we must one day spend our sunset years telling our children and our children's children what it once was like in America when men were free."

Labor

Gordon M. Freeman, International President of the IBEW reported a marked increase in apprentice training, from 2,200 completion certificates in 1959 to 3,400 in 1960. But, he continued, there is still much to be done if we are to insure to the electrical industry an adequate labor force of trained electricians.

He expressed extreme concern about the encroachment of other trades into the jurisdiction of electrical workers, particularly at missile bases.

"There is a tremendous volume of work which rightfully belongs to electrical contractors and the IBEW," he said, "that is being handled by other branches of the electrical industry, other branches of the construction industry, industrial and utility managements with their in-plant employees, and by other 'do-it-yourself' operators.

"Laws restricting strikes and picketing, and no raiding pacts make it practically impossible for the IBEW to take work away from another union once it has been assigned," he continued, and called upon the contractors to use creative selling to get the work and keep it.

President Freeman emphasized

that IBEW is a responsible union and will continue to be a responsible union although the Landrum-Griffin law is creating serious trouble. He cited the IBEW constitutional requirement that unions must have the permission of the International President before they can strike and the extraordinary record of the Council of Industrial Relations which has given stability and a "strikeless industry." Former Local 28 of Baltimore called a strike without approval and refused to take its grievance to the Council, as its agreement provided. Its charter was revoked after a public hearing. It is now suing the IBEW and its officers under provisions of the Landrum-Griffin act.

In closing, he said, "Our best tools for building as I see it are our joint training programs; the good selling job you in NECA can do; living up to our responsibilities in spite of obstacles, which IBEW can do, and the spirit of cooperation which exists between us which is perhaps our best tool for building. With these tools and the bright future which lies before us in the projected growth of the electrical industry, we cannot help but go forward together."

American industry must develop its own procedure for solving its own labor-management problems without relying on government assistance, or pressure, Assistant Secretary of Labor Jerry R. Holleman said.

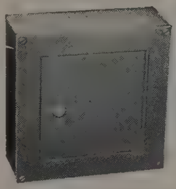
He commended NECA for its long history of accord in its dealings with labor organizations. Holleman also urged that the group take a leading part in the extension of their successful labor-management concepts and their industry system of resolving labor-management disputes to the rest of the construction industry and industry as a whole.

A. A. Anderson, New Britain, Conn.; Ray Meehan, Fischbach, Moore & Morrissey, Inc., Chicago, Ill.

Lots of live wires depend on the protection of Keystone wireways and auxiliary fittings. Quality features such as a completely open 'lay-in' design for fast, careful installation of wires, folded covers for added rigidity and interior screw tip shields—all help to keep electrical wiring *alive and well . . . permanently.*

Keystone has standard or galvanized wireways and fittings stocked in all types, shapes and sizes . . . ready for immediate delivery.

Lots of 'live wire buyers' know they can depend on Keystone . . . what about you?



Telephone Cabinets

JIC Pull Boxes

Wireways and Auxiliary Fittings

KEYSTONE
MANUFACTURING COMPANY
DIVISION OF AVIS INDUSTRIAL CORPORATION
23330 Sherwood Ave. • Warren, Michigan

I'VE SEEN IT—
YOU'LL LIKE
THIS NEW LINE

Ollie Windhorst, owner, Reddy Electric Co., Inc., Louisville, Kentucky

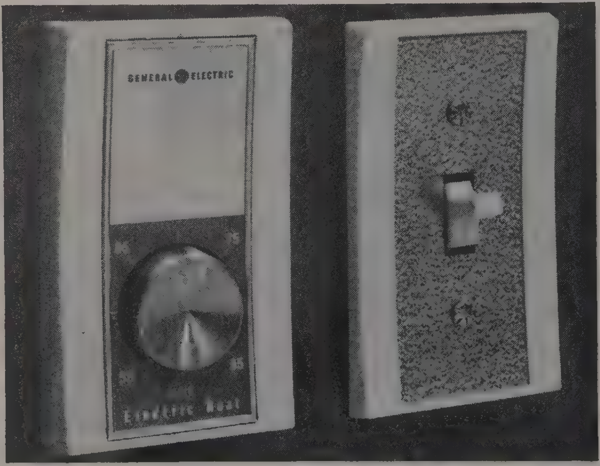
General Electric's new decorator room thermostats engineered for precise electric comfort heating control.

Handsome new room thermostat is a style leader in the pacesetting all-new line of electric comfort heating equipment—designed, engineered, and *manufactured* by General Electric. In brushed aluminum on ivory, the smart new thermostat has the same fresh look and dimensions as the popular General Electric decorator wall switch plates.

Extremely sensitive to both radiant and air temperature, differential is only ½ degree F. range 55 to 85 degrees F. Available in single pole with temporary shutdown position, and double pole with off position. High capacity with 5000 watts at 240 volts AC. Mechanical temperature locking device optional for both models.

FREE LITERATURE: for complete details and specifications, write 49-115-3 General Electric Company, Electric Comfort Heating Section, Appliance Park, Louisville 1, Kentucky.

280-04



New thermostat blends with popular G-E decorator wall plates.

Progress Is Our Most Important Product

GENERAL ELECTRIC

W. M. Deere, Wilson-Deere Electric Co., Kansas City, Mo.; F. W. Porter, Porter Electric Co., Inc., Kansas City, Mo.

He warned the group that labor-management discord like the type evidenced at the missile sites recently was the sort of thing that would set back industry as well as the nation.

Holleman told the contractors that they must accept the responsibility for quality training programs for the entire industry to keep the nation's skilled work force strong.

He also called for the abolition of racial discrimination in the trades "because, not only is it morally wrong, but this nation needs the hands of all Americans to counteract the huge work forces of our potential enemies."

Technical and Training Tools

Richard W. Osborn of St. Louis, Mo., chairman, NECA Codes and Standards Committee discussed "The Code—Our Basic Tool." He noted the importance of the code as the basic document of safe electrical practice and urged contractors to support the code. He invited contractors to familiarize themselves with the procedures for code changes and to participate in the constant development of the code.

Of particular interest to contractors was the effort being made to develop more literal phrasing in the code itself. Mr. Osborn pointed out the common problem faced by contractors when inspectors base their violation citations on "what the code intended to say here." This can be corrected by more direct and specific language, fastening a clear and uniform understanding of what the code says in its various requirements. The objective is to have the code say what it intends to say.

In an address, "What Price Accidents," Hugh McCahey, director, Small Business Division, National Safety Council, Chicago, Ill., discussed the huge dollar losses to contractors as a result of accidents. In 1960, accidents cost the members of NECA the profit on $355 million worth of business, Mr. McCahey reported. This and other data was developed from a recent survey conducted by NECA in cooperation with the National Safety Council. According to Mr. McCahey, the following information was revealed by the study:

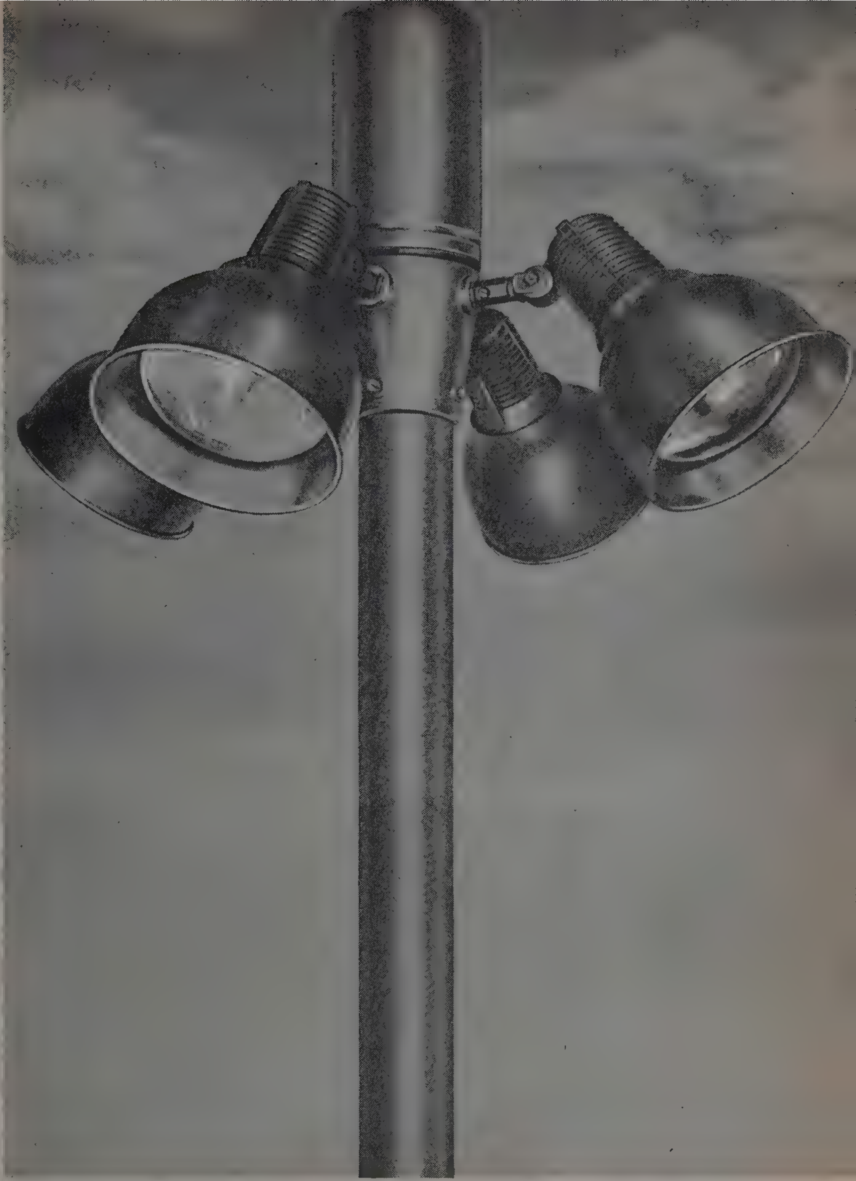
The disabling injury frequency rate in electrical contracting businesses was more than four times that for all industries reporting to the National Safety Council during 1960. It was 30% higher than the frequency rate reported by the construction industries.

Projected to the entire group of contractors who belong to NECA, the direct and indirect costs of accidents are estimated at $14,192,472. This astronomical figure breaks down to a cost of $184 per employee on the average. Of this total figure, $7,096,236 represents the cost electrical contractors reported from workmen's compensation premiums. The balance is the estimated indirect cost—such as damaged materials and equipment, time of other employees and managements spent on investigations and reports.

The smaller electrical contractors have a disabling injury frequency rate noticeably higher than the larger firms.

As a follow up to the study of accident costs, Richard L. Aldstadt, Employers Mutuals of Wausau, Washington, D. C., introduced the subject of safety and presented a color-sound film on the importance of safety to contractors. The film described the operations of a contractor who was losing out on bid work because of the hidden costs of accidents on his jobs. The contractor finds this out, institutes a vigorous safety program and eliminates the accident costs which were loading his bids.

Robert G. Frame, chairman, NECA Research Committee, Pittsburgh, Pa., discussed the Technical and Training Service tools which the NECA provides for its members. Entitled "We Need to be the Best" his talk reviewed the available programs for developing the contractor in all phases of his business. In particular, there are the various workshop programs available to local chapters and conducted by trained NECA staff personnel. A "workshop" consists of a full two- or three-day meetings for a total of 12 to 16 hours, depending upon the subject.



A four-lamp 400 watt transformer is the least unusual feature of this mercury vapor cluster

Here is the first four-lamp 400 watt constant wattage transformer.

You can bet it's easier to work with than two separate two-lamp transformers.

Costs less, too. (As does our new two-lamp 1000 watt transformer.)

Surprising isn't it that no one thought of these before.

But the pleasantest surprise is the fixtures themselves.

Clean. Compact. Remarkably well-constructed.

Including a patented full floating-socket with all stainless steel hardware that keeps cool around mercury vapor lamps.

(Sealed-beam lamps. Never need cleaning. Stay brilliant, even in hazardous areas choked with soot, smoke or chemicals.)

What do you want from a mercury vapor floodlight? Higher lumen output? Longer lamp life? Lower power consumption?

Stonco sealed-beam mercury vapor gives you all of this.

At far less cost.

STONCO *lighting*

© 1961 STONCO ELECTRIC PRODUCTS CO., KENILWORTH, NEW JERSEY / *Write for Catalog MV*

In an address on "Improving the Estimating Tools," D. B. Haring, secretary, Association of Electrical Construction Engineers, New York, N. Y., made the following points:

"Estimating, to borrow a term from one of President Webster's recent messages, is truly a 'tool for survival' in our free enterprise system. There can be no denying the number of financial disasters produced in our industry by uninformed estimating.

"The effort to measure labor costs is not a large one and, if properly done, will repay you many times in the saving of sweat, tears, and money. The labor cost system is a simple one in concept—an over-all reporting of job man-hours, an analysis procedure, a recheck in the field for spot features and a permanent cataloging of the final results.

"There are other important benefits to be gained by rigorous progressive labor cost analysis. Not only are costly inefficient installation procedures recognized and caught in time but, where existing, items of work beyond the contract scope are defined early in the job and efforts can be made on a more successful basis to negotiate for additional income. Also, there can be a rapid feedback of the latest labor data to the Estimating Department so that errors in estimating judgment can be corrected promptly and current estimates may benefit."

Dean Ernest E. McMahon, Rutgers University, Newark, N. J., in an address entitled "Making Use of the Training Tools," emphasized the importance of education as a building tool. He urged contractors to continuously avail themselves of education and instruction in all phases of their work and to see to continuing education for their employees. Vocational training, Dean McMahon noted, is an excellent and readily available tool for use by contractors.

B. N. Voss, president, Eastern Oklahoma (Tulsa) Chapter of NECA, spoke on "The Scholarship Tool." He pointed out the advantages which can be gained by the electrical construction industry from the adoption by colleges of a curriculum leading to degrees in electrical contracting. He noted that efforts were being made in this direction.

"New Aspects of Small Business Financing" was discussed by Logan B. Hendricks, director, Loan Processing, Small Business Administration, Washington, D. C. Highlights from his talk include the following:

IN ELECTRIC HEAT THERMOSTATS... WHITE-RODGERS IS THE LEADER!

Use them with confidence—they're specifically designed for Electric Heat by White-Rodgers—world's largest maker.

Sold under the brand names of more than fifty manufacturers of quality electric heating equipment.

Type 1A61 World's Largest Seller

Type 1A65 Elegant New Companion

LIVE BETTER ELECTRICALLY

WHITE-RODGERS CO., ST. LOUIS 23, MISSOURI TORONTO 8, CANADA

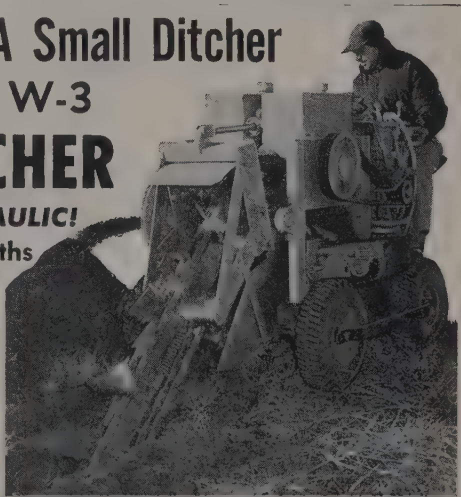
All You Want In A Small Ditcher

Vermeer Model W-3

POW-R-DITCHER

FAST! RUGGED! HYDRAULIC!

Digs 3" to 12" Widths

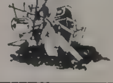


Equipped with 18 hp. engine, the rugged Model W-3 POW-R-DITCHER is ideal for contractors, municipalities, utilities and custom operators. Rubber-tired wheels or crawler tracks. Hydraulic drive system — no shifting. 2-way dirt conveyor. Ask for a demonstration.

PICK THE POW-R-DITCHER TO FIT YOUR NEEDS

524T

4T



W-1

3P

Please send me FREE information and prices on the complete Vermeer line of self-propelled POW-R-DITCHERS.

NAME...

FIRM...

ADDRESS..

CITY.............................STATE.......................

☐ Also include information on new Vermeer hydraulic back filler.

VERMEER MANUFACTURING COMPANY

1460 W. WASHINGTON • PELLA, IOWA

Vernon Goldeke, Standard Electric Co., Memphis, Tenn.; J. W. Hunt, Industrial Electric Co., Memphis, Tenn.

"We co-sponsor with many colleges and universities hundreds of management training courses which have been well attended by about 37,000 proprietors or managers of small businesses. We also publish a wide variety of booklets and leaflets all designed to assist small business managers and owners to strengthen their management skills and improve their business practices. In addition, we have financed more than 100 research studies into problems of small businesses.

"The Small Business Administration is an independent agency of the Federal Government. Its sole job is to help small business, to see to it that the little fellow has a chance and is not squeezed out by the giants of the business and industrial world. SBA also licenses, regulates and helps finance Small Business Investment companies. These companies are privately owned, and their sole function is to provide long term and equity financing for small firms. We also make disaster loans to businesses and to home owners as well, when their property has been damaged or destroyed by natural disasters. These loans are made at 3% interest and have been an important factor in helping stricken areas rebuild in the wake of floods, hurricanes and other calamities.

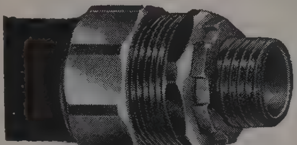
"Small manufacturers, wholesalers, retailers, service establishments and other small businesses are eligible for SBA loans for these purposes: business construction, conversion or expansion; the purchase of equipment, facilities, machinery, supplies or materials; or for working capital. To qualify for SBA assistance a firm must be small and must meet our small business definition which is that annual gross sales be under $5,000,000."

Pensions and other compensation programs for executive personnel

IDEAL

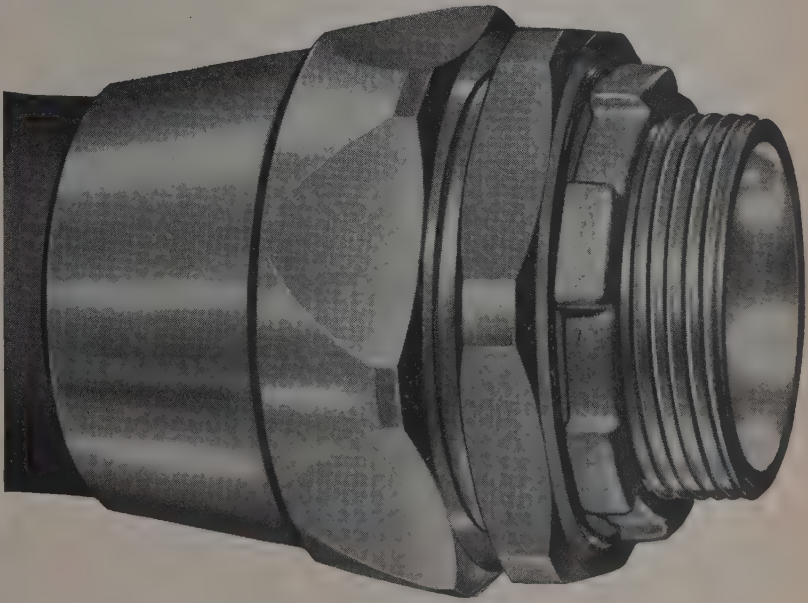
VAP-OIL-TITE CONNECTORS

- *for use with liquid-tight flexible, metallic conduit*
- *absolute water and oil-tight seal — vapor, dust, grit can't penetrate*



STANDARD SIZES — ⅜" to 2"
Available in 3 styles — straight, 90° angle and 45° angle. U.L. and J.I.C. approved. Fit both EF and UA conduit. Seven sizes for each style from ⅜" to 2" conveniently packaged in lots of 5 to 100, or by carton...priced right!

LARGE SIZES—2½", 3", 4"
Straight style only. Double O-ring neoprene seals prevent foreign matter penetration—**nothing can get through!** Extra long skirt prevents damage to conduit. Three sizes, 2½", 3" and 4" packaged individually — at the right price!



EASIEST TO APPLY--NEVER PULL APART
The *only* completely reusable connectors for OEM, replacement and maintenance, and machinery applications where a positive seal against water and oil is a must!

WANT DETAILS? ...send coupon NOW

IDEAL INDUSTRIES, Inc.
1041-K Park Ave., Sycamore, Ill.
IDEAL
Send Vap-Oil-Tite Catalog data
Name__________
Company__________
Address__________
City__________ Zone_____ State_____

for "FREE AIR" Rating of CONDUCTORS

SEPARATORS used with "Ventilated" FULL-FLEX is your answer!

Designed for RIGID or FLEXIBLE USE

Full-Flex is new, it is different, but yet in its application and use, it follows proven procedures which have been developed through years in the standard cable carrying and supporting systems.

Full-Flex may be used for rigid installations up to 14 feet on channel center lines, or as catenaries up to 400 feet or more. Full-Flex may easily be taken apart and reused as required. Write for Bulletin No. 5.

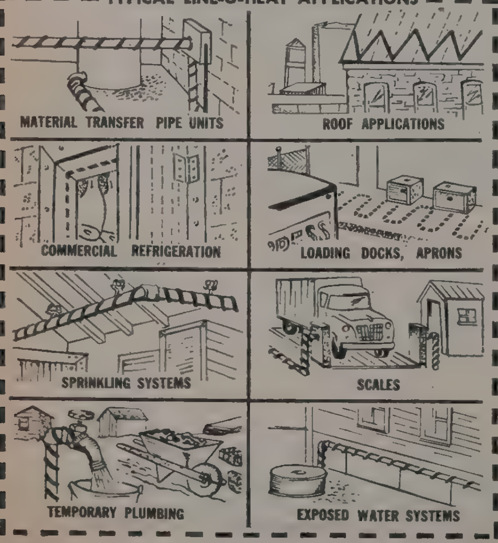
Fullman Manufacturing Company
FLOOR BOXES • WIRING SPECIALTIES • FLEXIBLE CONDUIT
1209-1215 Jefferson Street
LATROBE, PA.

1001 WAYS TO MAKE MONEY WITH . . . LINE-O-HEAT®

LARGEST-SELLING HEATING TAPE IN THE WORLD

Line-O-Heat, rated at 6 watts per foot, provides localized low-temperature heat to prevent water pipes from freezing and for 1,001 other purposes. It is flexible, readily adaptable, easy to use. Line-O-Heat is inexpensive to buy and operate, and it is free-replacement guaranteed!

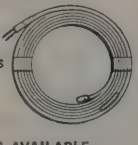
TYPICAL LINE-O-HEAT APPLICATIONS



FOR 120-VOLT SERVICE

Regular and Automatic Line-O-Heat with built-in thermostat set to operate at 38°F. is available in ten lengths from 4' to 80'.

FOR 240-VOLT SERVICE



Ten lengths from 8' to 160' for use where longer lengths of heating tape are needed. Has 3' cold lead, no plug.

THERMOSTATS AVAILABLE
WRITE FOR FREE LITERATURE
THE SMITH-GATES CORP.
FARMINGTON, CONN.

of contracting firms was the basis of the talk, "Tax Free Dollars for Executive Compensation," by I. Austin Kelley, III, president, National Employee Relation Institute, New York, N. Y. Mr. Kelley presented typical examples of financial arrangements by which compensation could be most profitably provided.

Market Development

NECA's Market Development program was outlined and discussed by six speakers, in the third general membership session chairmanned by NECA Vice President Norman D. Ferguson, Calewo, San Diego. "The training emphasis will now be on selling," Mr. Ferguson said, "and will include sales training, advertising, sales promotion and market research." It was pointed out that electrical contractor's dollar volume is not keeping pace with industry growth, and that electrical contractors are doing very little creative selling — they are still depending on the building construction market for their volume, which must be taken under low-profit competitive bidding.

John A. Spencer, manager of marketing Personnel Service, General Electric Co., discussed "The Effective Use of Modern Sales Tools." "Nothing is really accomplished in a business until somebody makes a sale," he said, as he proceeded to point out why salesmanship is now developing into a profession.

Mr. Spencer suggested the use of three usable, tested and modern selling tools. The first was "presale preparation"—complete analysis of your own offering, the customer himself, development of intelligence concerning your competition, plus analysis and the gathering of all pertinent facts, and writing them down.

His second selling tool was "You have to sell value instead of price," which is done in many instances, he said, and not to the lowest bidder. This tool can help rid the industry of its "bid shopping disease," he said.

The third example of a modern selling tool was "Remember, what you are really selling is people," and is an important contact between two human beings, Mr. Spencer pointed out.

"TEL — The Teamwork Sales Tool" is the title of a talk presented by John H. K. Shannahan, assistant vice president, American Electric Power Service Corp. He reviewed the Live Better Electrically

T. J. Fogarty, Ledbetter Electric Co., St. Louis, Mo.; Francis Aschinger, Aschinger Electric Co., St. Louis, Mo.

program and the impact it will have on the business of electrical contractors. He described the national advertising program which will be carried on by Edison Electric Institute in 1962, including a series of 12 four-color appliance ads, 13 ads on Medallion homes featuring heating, appliances, lighting and housepower, 22 ads on electric heating, and an 8-page 4-color detachable insert featuring electric heating and air conditioning in February 1962 *Reader's Digest.* This national advertising program will be further augmented by local programs by electric utilities across the country, and by manufacturers of electrical equipment.

Norman D. Ferguson, Calewo, San Diego, described the new NECA Marketing Committee, which has wrapped up in a new package, the Salespower Program. This program is geared to the premise that "creative selling must replace price-tag selling," he said. The tools in the package include:

Advertising—Currently, ads tell about qualified NECA contractors. The long-term goal is aimed at the modernization market.

Sell-By-Mail Kit—A direct-mail program designed for local use.

Electric Heat Promotion—Design, installation, insulation, financing, bonded guarantee.

Cooperative Sales Agreement—A new voluntary, cooperative plan to be participated in by contractor and his supplier.

Cooperative Sales Plans—A sales plan to be worked out with any supplier.

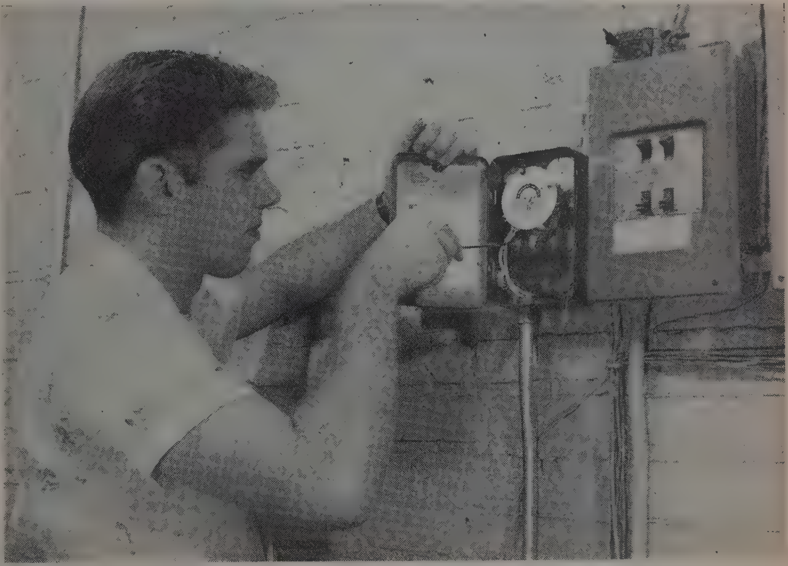
Market Surveys—A new method for making a local market survey.

Salesman Hiring Kit—Contains several forms which help in interview and selection of salesman.

NECA Sales Courses—Two sales training courses for commercial-industrial-institutional, and residential.

NECA Sales Institute—An intensive 5-day sales training course

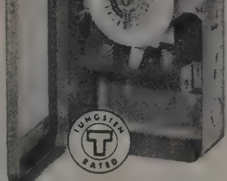
ELECTRICAL CONTRACTOR
meets
Intermatic®
TIME SWITCHES
Result: MORE DEPENDABILITY



It's the tough jobs that separate a quality product from an "also ran." That's why more and more Electrical Contractors are using Intermatic switches for every conceivable timing job. They count on engineered Intermatic reliability and accuracy for top-notch operation year in and year out under the most extreme conditions. Reliability that means more customer satisfaction and fewer call backs to save you time and money on every job!

REASONS "WHY" INTERMATIC IS YOUR BEST BUY!
Snap-out mechanism for faster, easier mounting . . . 31 cubic inches of wiring space to work in without getting finger cramp . . . Top on the job performance with a heavy duty motor and 40 Amp rating (4375 watts tungsten rated) . . . Hi-Power switching mechanism and U-Beam Switch Blades assure long life . . . E-Z See Dial for faster, more accurate settings. It figures: Intermatic gives more switch for every dollar . . . more performance for every job.

OVER 100 MODELS TO CHOOSE FROM
• 125-250 Volts • 10 seconds to 23 hour timings • 1 to 96 operations per day • Up to 55 Amps • One or two circuits • Standard or "Skipper" models • NEW ASTRONOMIC DIAL SERIES

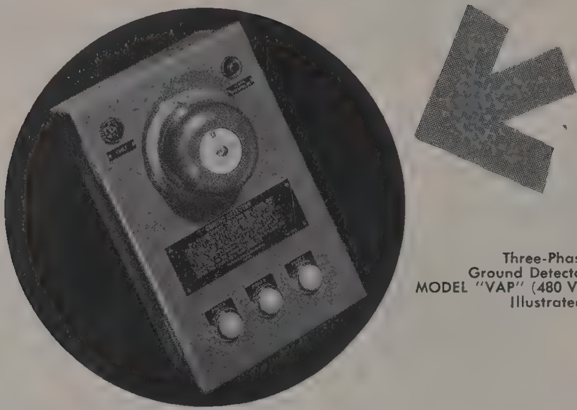


UL and CSA APPROVED

For FREE illustrated color catalog
MAIL THIS COUPON TODAY!

INTERNATIONAL REGISTER COMPANY
2624 W. Washington Blvd., Chicago 12, Illinois
Gentlemen: Please send me your catalog on the complete Intermatic Time Switch line. Bulletin 111-B
NAME
COMPANY
ADDRESS
CITY ZONE STATE
MY DISTRIBUTOR IS

Erickson GROUND DETECTOR



Three-Phase Ground Detector MODEL "VAP" (480 V.) Illustrated.

Positive detection of ground fault to prevent unscheduled shutdown and possible hazard, damage and expense.

Write today for literature on the Erickson line of Ground Detectors.

Manufacturers of Panel Boards • Switchboards • Metering Equipment • Ground Detectors.

Erickson
ELECTRICAL EQUIPMENT CO.
4460 N. ELSTON AVE. • CHICAGO 30, ILLINOIS
SPring 7-8670

SHERMAN TERMINAL LUGS AND CRIMPING TOOLS

SPEED INSTALLATION — REDUCE COSTS!

INDENTED CRIMP FOR GREATER RESISTANCE TO PULL-OUT

S

MONEY SAVER
SAVE UP TO 15% WITH SHERMAN
Write for FREE Sample

SHERMAN UNI-CRIMP LUG

SHERMAN "ST" LUG

SHERMAN HAND CRIMPING TOOLS
Portable or bench mounted for fast, easy installation of money-saving Sherman terminal lugs.

H. B. SHERMAN MANUFACTURING CO., BATTLE CREEK, MICHIGAN

which covers the information needed for setting up a creative selling program.

Four electrical contractors formed a Contractor Panel to discuss "Sales Tools in Action." These contractors were: Walter Murphy, Crest Electric Co., St. Louis; Allen F. Knickrehm, The Knickrehm Co., Los Angeles; Wm. Collins, Collins Construction Co., St. Paul; and Dewey Smith, Dewey Electric Co., Ventura, Ohio. Each contractor described his specialty, and how he operates profitably.

Jeff Coates, Professional Sales Development Co., talked about sales creativity in his discussion titled "The Greatest Salespower," pointing out that creative selling is diametrically opposed to the philosophy of competition.

Reports

Clint J. Harder, secretary-treasurer, reported an increase in membership of 74 since January 1 to August 31. At the present time it numbers 4,318. By December 31, a membership of 4,400 is expected.

For the first eight months of 1961, the net income from dues and services amounted to $1,174,523, and net expenditures amounted to $676,281.

Paul M. Geary, executive vice president, reported "The financial status is sound but the membership status is not good. Approximately 4300 members out of a known potential of about 12,000 is nothing to brag about. Of course, our 4300 members do about 63% of the industry's recorded volume, but we cannot afford to lose sight of the importance of numerical representation and its influence. The Association is hardly representative in some phases of the industry." He also reported on the association's various programs—public relations, business development, labor relations, technical and training.

Resolutions

The following resolutions were passed:

1. That NECA urge the appropriate agency of the federal government to undertake immediately a study of the design and equipment necessary for defense shelters with a view to expeditious construction of them with such federal aid as may be required, and that steps be taken for the selection and designation of public and private lands, including the right to condemn old buildings on strategic locations, and further, that the federal government give priority to the development and application of this and

other practical civil defense provisions.

2. That the federal government by administrative or legislative action take such steps as necessary to end the practice of federal construction agencies of withholding payments on change orders to renegotiate the price, and to request the General Accounting Office to discourage such practice.

3. That NECA requests that Selective Service and other agencies of the federal government involved designate the apprenticeship and training program of the electrical contracting industry as a category of highly skilled, essential trade, and that to the greatest extent consistent with the national safety provide for deferment from military service of the young men properly enrolled in this program until they have completed their entire apprentice training course.

4. That the Federal Government by administrative or legislative action take such steps as necessary to require that foreign structures built with United States foreign aid funds be constructed either by the use of native labor, material and construction firms or United States labor, material and construction firms or a combination of both.

5. That NECA restates its opposition to the inept intrusion by government in the normal business processes of the construction industry and calls upon the elimination of the set aside program and the exemption of the construction industry from Small Business Administration regulation by administrative or legislative action.

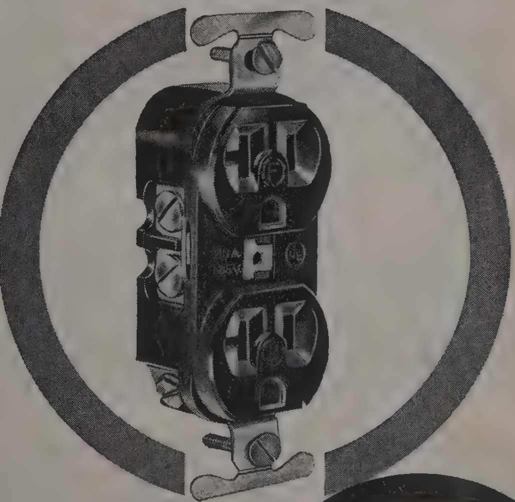
Election of Officers

Harold A. Webster, T. Frederick Jackson, Inc., Long Island City, N. Y., was re-elected president of NECA.

Six vice presidential elections also were decided at the Board of Governors meeting. Elected unanimously as District 1 Vice President was R. J. Knoblock, Krause & Heil, Inc., Syracuse, N. Y.; and J. W. Slaughter, S & S Construction Co., Inc., Olathe, Kansas, as vice president of District 5.

Re-elected vice presidents were Carl L. Teal, Knight Electric Co., Birmingham, Ala., District 3; R. W. Osborn, Osborn Electric Co., St. Louis, Mo., District 7; Norman D. Ferguson, California Electric Works, San Diego, Calif., District 9; and Gordon S. Heylin, Utilities Line Construction Co., Jenkintown, Pa., vice president, Line Construction.

NEW
CIRCLE F
20-AMP
"U"-GROUND DEVICES



. . . Section 220-3 (b) of the 1959 National Electrical Code states . . .

"For the small appliance load in kitchen, laundry, pantry, dining room and breakfast room of dwelling occupancies, (1) 2 or more 20-ampere branch circuits in addition to the branch circuits specified in paragraph 220-3 (a) shall be provided for all receptacle outlets (other than outlets for clocks) in these rooms, and such circuits shall have no other outlets."

Designed to provide full compliance with the revised Code, Circle F's *new* No. 2532 does much more! It becomes a "universal" outlet! It accommodates appliances, heavy-duty portable tools, business machines, etc., having substantial energy requirements, where the new 20 A.-125 V. plug cap (No. 2528) is necessary. It also accommodates 15 A.-125 V. 3 wire U-ground and standard parallel blade caps. One outlet for all! Circle F's quality is tops and the price is right. Contact your Circle F representative for complete details.

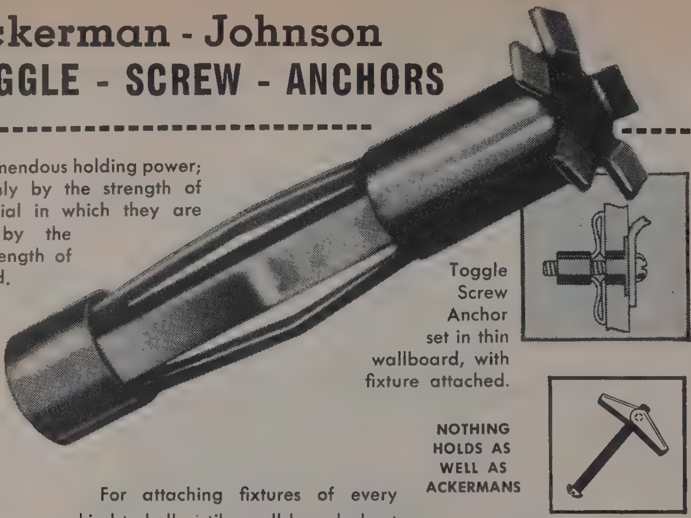
GUARANTEED WIRING DEVICES

CIRCLE F MFG. CO.

TRENTON 4, NEW JERSEY

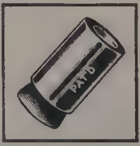
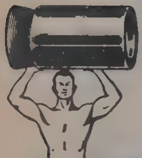
Ackerman - Johnson
TOGGLE - SCREW - ANCHORS

Have tremendous holding power; limited only by the strength of the material in which they are set, or by the tensile strength of screw used.


Toggle Screw Anchor set in thin wallboard, with fixture attached.

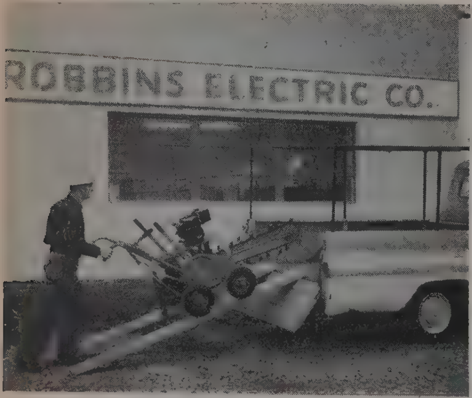
NOTHING HOLDS AS WELL AS ACKERMANS

For attaching fixtures of every kind to hollow tile, wall board, sheet metal, thin panels, soft wood, solid or hollow gypsum, metal or wood lath and plaster, open back marble, cork, glass, etc., etc.

Write for new catalog covering Complete Line of Fastening Devices

Ackerman-Johnson Co.
625 WEST JACKSON BLVD., CHICAGO • 55 PARK PLACE, NEW YORK
ORIGINATORS OF THE EXPANSIVE SCREW ANCHOR



ELECTRICAL CONTRACTORS USE POW-R-SPADE to lay cable and conduit. Savings and extra profits on every job. Have your own machine. No waiting. No delays.

POW-R-SPADE
PORTABLE TRENCHER

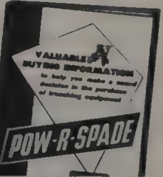
"A labor saver, easy to operate, and profitable"

Fast trenching at lowest cost. Reduces man-hours to minutes. Eliminates disadvantages of subcontracting. A profitable, inexpensive machine to own and operate.

- Digs 3 in. wide by 1 to 24 in. deep; or 4 in. wide by 18 in. deep
- Light weight, compact, portable
- Since 1956 satisfied users all over U. S. A.
- Dependable trouble-free trenching at lowest cost.
- Digs 1½ to 17 ft. per minute, depending on soil conditions

Digs straight, curves, or angles without special set-up. Comes completely assembled. One man operation from start to finish.

FOR FREE BOOK ON POW-R-SPADE AND PRICES CALL COLLECT 788-9527



OR TEAR OUT THIS AD — ATTACH TO LETTERHEAD AND MAIL DIRECT

STAMPINGS, INC.
Dept. E, Rock Island, Illinois

Management Analyzed At EASA Conference

George Larson, Larson-Hogue Electric, Los Angeles, national president of the Electrical Apparatus Service Association, focused attention upon EASA management seminars and electronic service courses in keynoting a 2-day western regional meeting held in Anaheim, Calif., Sept. 22-23. Courses such as these are essential in any rapidly growing industry, he said, and although EASA's national seminars cost more to hold than the fees they produce, such financial sacrifice seems justified and necessary to further the knowledge and quality of service being offered by participating members. George's brother Bill echoed this industry contribution, stating that motor repair shops must look beyond the winding bench and consider the increasing complexity of management, finances, taxes and insurance problems.

In a related panel discussion moderated by Frank Search of Frank's Elec. Co., Long Beach, Basic Management Principles were analyzed by Melville Dalton of U. C. L. A.; Industrial Relations were investigated by Edwin Cochran, Alexander-Williams Co., Santa Ana, and Purchasing and Inventory Control Records were considered by Earl Sweinhart, Sweinhart Elec., Los Angeles. At the same session, Lloyd S. Cope of Advance Elec., Anaheim, discussed pre-planned facilities and layout of a new shop, while David Dehlinger of Larson-Hogue reviewed that company's handling of warranty jobs and comeback work.

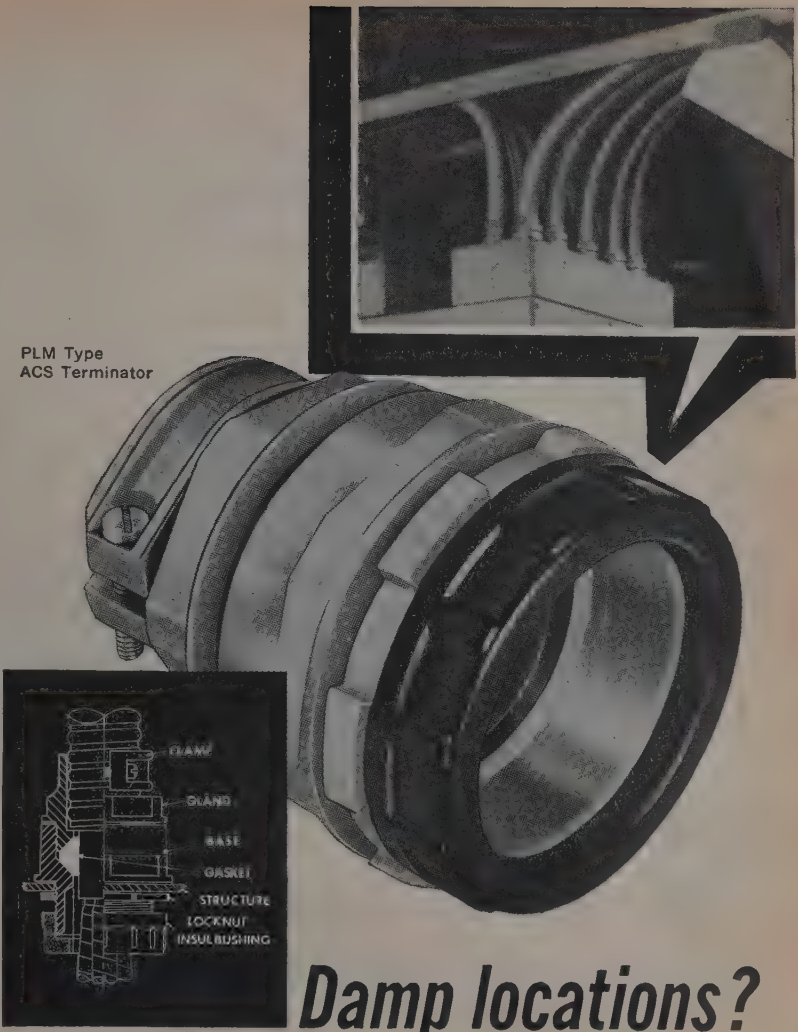
The second day of the conference continued the theme of office management during a forum meeting moderated by Mayo Baker of the Littlejohn-Reuland Corp., L. A. On this panel, Michael J. Kovall, Kovall Elec., Hollywood, reported upon former management seminars held in the northwest, urging that similar ventures be scheduled for other sections of the country as well. This second day's program likewise included discussions on the value of records, by Cress Crotwell, Smallcomb Electric, L. A.; the necessity for promoting accessory services and products in order to remain competitive as well as fully integrated, by Bernard Marcus, Marcus Elec., Glendale; also the part that insurance plays in the motor maintenance field, by insurance consultants Frank Scolly and John Krehbiel of Pasadena.

FAEC Holds Annual Convention

The Florida Association of Electrical Contractors held its 1961 Convention and Annual Meeting on September 29-30, at the Jack Tar Harrison Hotel in Clearwater, Fla. Nearly 200 members and guests registered for the two-day meeting.

Breaking with tradition of the past few years, FAEC did not sponsor an electrical trade show this year. Instead, a busy and carefully-planned program designed to provide the utmost in business guidance, market analysis and industry outlook for profit, and fellowship and fun for members, distributors, guests, and their families, was presented and followed. This permitted full attendance and undivided attention at all sessions, and full concentration on the subjects under discussion and study. Officers and members alike were pleased with this break in pace, and with the many new business matters of vital importance to the Association membership which were released and discussed for the first during this conference.

The convention got underway with the opening of the first business session, chairmanned by James R. Ward, FAEC president. Henry C. Coleman, chairman of the board of the Commercial Bank of Daytona Beach, was the keynote speaker. Keying his talk to "Freedom," Mr. Coleman pointed out that no longer is "everything all right" in America, but that our "freedom"—birthright and heritage—is in danger and that the danger springs from the continuing decreases in freedom brought about by what is happening in government. He described this as: a) Government centralization, and continuing encroachments on States Rights; b) Increasing cost of government (compared industrial products cost increases with government spending increases); c) Inefficiency in government (part of the increasing cost of government), citing many examples; d) Government competition with private enterprise (now conducting 3300 businesses in direct competition with private industry); e) Influence of pressure groups, with special attention to farm and labor groups; and several others. Referring to labor union policies and activities he declared that it is axiomatic that "we cannot have more so long as we continue to produce less." Also, referring to government policies


PLM Type
ACS Terminator

Damp locations?

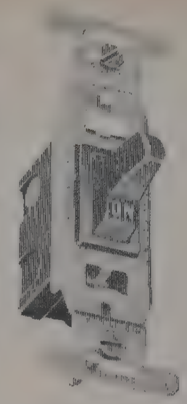
There's a PLM fitting to fit the job!

Installing armored cable where conditions call for moisture-tight terminators? There's a PLM fitting to fit the job—as well as others to fit almost any other type of indoor or outdoor mounting requirement!

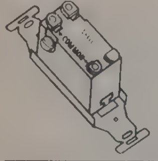
PLM terminators for armored cable, and PLM terminating and splicing kits for armored, non-metallic jacketed and lead-covered cable through 23 kv. can simplify and speed up any cable installation and repair. Get full information on these time and money saving PLM products. They are fully described in PLM 52-page catalog 301. Write for copy on your letterhead.

PLM Products, Inc
TERMINATING AND SPLICING ACCESSORIES
3875 WEST 150th STREET • CLEVELAND 11, OHIO

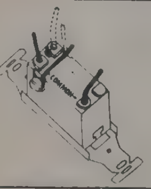
THE
SWITCH
IS ON
TO
EAGLE



QUIET SWITCHES
AN E-Z WIRE® DEVICE
NOW AVAILABLE WITH
TOGGLE HANDLES
15A and 20A-120-277V AC SINGLE POLE, 3 WAY, DOUBLE POLE, 4 WAY IN FLUSH AND INTERCHANGE TYPES
(ALSO AVAILABLE IN TOUCH-A-MATIC TYPES)
MEETS FED. SPECS.
PAT. NO. 2,743,330



WITH BOTH screw and E-Z WIRE *pressure terminals*



3 COMMON TERMINALS for convenient feed thru connections

In Cello-Wrapped EAGLE "SHO-PAK"

Specified by Contractors, Architects, Consulting Engineers for Commercial, Industrial Residential installations — for quality, trouble-free performance—for better profit margins. Specify Eagle quiet Switches for your next job — and profit.

OUTSTANDING SWITCHES ARE MADE BY EAGLE. SEND FOR FREE SAMPLE & LITERATURE.

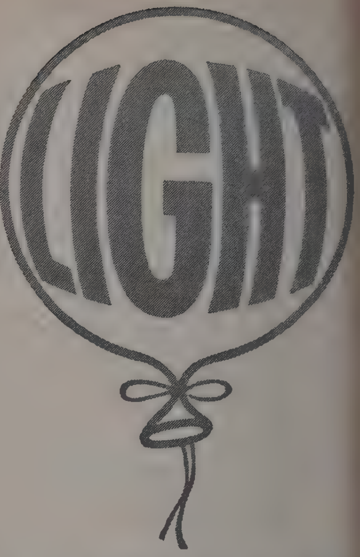
"Perfection is not an Accident"
EAGLE ELECTRIC
MFG. CO., INC.
LONG ISLAND CITY 1, NEW YORK

with respect to our national economy, he said it is also axiomatic that "we cannot spend ourselves rich." He urged conference members to take a keener interest in government activities, and politics, and to make their wishes known to their Congressmen. The "voice of business" must be heard, he said, as he pointed out how other groups are organized and are spending millions of dollars on lobbying at both the state and federal levels.

The relation of the "Architect and the Electrical Contractor" was discussed by John Yates Bruce, architect, Tampa-St. Petersburg-Clearwater area. Electrical contractors should give more attention to quality of workmanship, as poor quality work reflects on architects, results in the architect being called back to the job after completion more than any other factor, he said. The architect wants contractors he can depend upon without minute supervision. He urged a greater spirit of cooperativeness, greater effort of contractors to help sell quality jobs, less offering of "substitutes" on contracts, and more capability and dependability. He suggested electrical contractors make themselves available for giving talks at monthly and annual meetings of the American Institute of Architects, where a spirit of better cooperation and better understanding between architects and electrical contractors can be developed.

William B. Shenk, vice president of Florida Power Corporation, discussed the "Utility Company's Relationship With the Electrical Contractor." Having addressed this group in past years on this same subject, he merely made a quick updating of promotional activities, the economic outlook, and progress in such programs as Live Better Electrically, Medallion Homes, etc. Then, speaking as "an American citizen who has become deeply concerned about what is happening in the Federal Government," he proceeded to point out and discuss "the many ways our national leaders are now taking America down the road to Socialism."

First of his many points was the headline-catching news, Government sponsored in conjunction with the White House party for TVA directors on the occasion of the celebration of the 100th anniversary of the birth of Nebraska Socialist George W. Norris, founder of socialized electric power in the U.S., that TVA had announced a reduction of 8% in its electric



WEIGHT

REYNOLDS ALUMINUM RIGID CONDUIT

★ Easy to Cut
★ Easy to Thread
★ Easy to Handle
★ Easy to Bend
★ Less Voltage Drop
★ Locally Stocked

For complete information and names of Reynolds Aluminum Rigid Conduit Distributors, call your Reynolds Sales Office, or write: *Reynolds Metals Company, Box 2346-ET, Richmond 18, Virginia.*

rates. The truth was that "TVA didn't make any reduction in its rates at all," but merely gave its permission for cooperatives and municipally-owned utilities in that area to adopt rates that would be 8% less than the lowest rates permitted up to that time. None of the distributors are required to reduce rates, and none are expected to adopt these new lowest permitted rates.

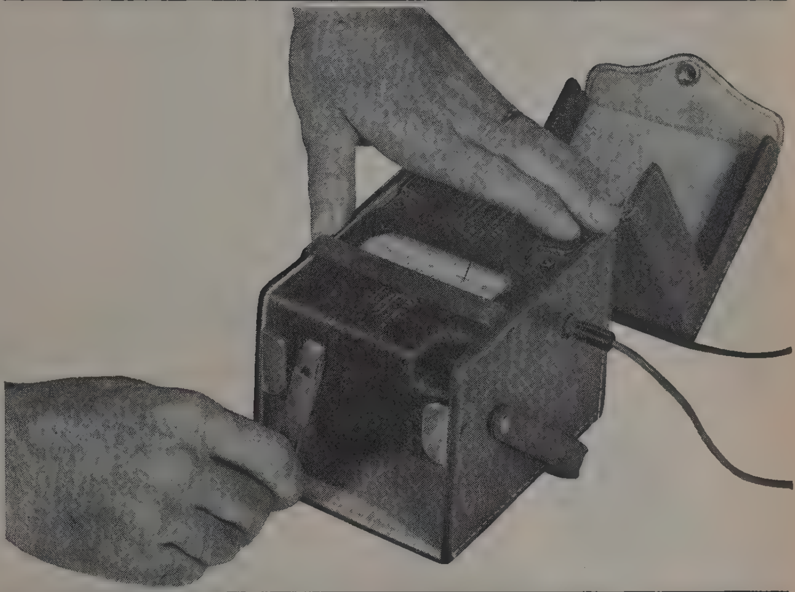
James Meier, president of Florida Electric Supply, Inc., spoke on the Electrical Distributor Program for Electrical Contractors, stressing the interdependence of the two groups. Manufacturers depend on distributors for sales and service of their products, he said, and the distributors in turn depend upon the electrical contractors. Electric utilities depend upon all three for market promotion, he said. Among his many suggestions for improving the lot of all segments of the industry, he suggested that all stop fighting the problems and take steps to correct them; and stop being negative, but all groups each take necessary steps to total effort.

Another talk which generated considerable delegate response during a Q and A period, was that by Ivon Tilyou, executive director of the Peace River Valley (Florida) Electrical Cooperative, who described the new "REA Electrical Codes" developed and put into use by his Coop. group. The new Codes cover wiring specifications for the Coop. rural areas, in areas not subject to usual code rulings. The code went into effect August 1, 1961, and the Coop. does its own inspecting.

John J. Neasbe of National Cash Register Co. conducted a Business Management Seminar, in which business machines and how they can serve the bookkeeping, cost accounting, billing, record keeping, and similar functions of electrical contractors were discussed. Mr. Neasbe recommended that electrical contractors call in a business machine representative who can make a survey of his requirements and come up with a specific recommendation of equipment needed; with the wide range and variety of equipments that are available, this is the most practical approach.

The third business session was devoted to a 3-man panel on Bid Procedures, in which each panel member described a different type of bid procedure. As pointed out by session chairman Tom Drage, FAEC was not proposing or sponsoring any of these procedures, but

NEW MARK III
MEGGER® INSULATION TESTER



COMBINES POPULAR MIDGET MEGGER FEATURES WITH IMPORTANT NEW IMPROVEMENTS:

CONSTANT TESTING VOLTAGE • MEGOHM AND OHM SCALES

Compact, completely self-contained Mark III instruments require no batteries or other power supply. Built-in hand-driven generator with folding crank provides constant testing voltage for circuits with capacitance of up to 4 microfarads. Specially designed ohmmeter measures value of insulation resistance directly in megohms; double scale instruments *including* ohm scale also available on all models. Leads store in handy camera type case, plug into spring plunger type terminals for use. Ideal for detecting faulty insulation on motors, generators, rotary converters, transformers, power cables and wiring, lighting circuits, control equipment and wiring. Available in three models for a wide range of testing applications.

Voltage	Range
100 volt	0.02-20 megohms
250 volt	0.05-50 megohms
500 volt	0.1 -100 megohms
All models available with 0-10,000 ohm scale	

The new, improved Mark III is the *practical* answer to the need for test accuracy and dependability at low instrument cost. Write for Bulletin 21-85-ECM.

B-123

BIDDLE INSTRUMENTS

JAMES G. BIDDLE CO.
Electrical & Speed Measuring Instruments
1316 ARCH STREET • PHILADELPHIA 7, PA.

Another ARROW CONDUIT
EXCLUSIVE!

ARO-GARD*
PROTECTIVE COATING
TRADE MARK

KEEPS CONCRETE OUT
OF TAPPED HOLES
IN CONCRETE RINGS

* Pat. Pending

Now, one more of your big costly installation problems is eliminated... no more wasted time in cleaning concrete out of tapped holes! "ARO-GARD", Arrow Conduit's new protective plastic compound, covers tapped holes during manufacturing process. "ARO-GARD" is hard enough to keep concrete out of tapped holes—yet soft enough to allow screw to penetrate protective film with ease.

"ARO-GARD" is easily identified by green color (see shaded area in illus.). Now available on all Arrow Conduit Concrete Rings, at NO ADDITIONAL COST TO YOU.

Write for samples and data of "ARO-GARD" application process.

New Products from Arrow Conduit help you keep pace with modern wiring needs.

OUTLET BOXES • GANG BOXES •
COVERS • BOX SUPPORTS

ARROW CONDUIT
& FITTINGS CORP.
108-20 180th Street, Jamaica 33, N. Y.

ARROW CONDUIT & FITTINGS CORP

Sales Representatives & *Warehouse Stocks *ATLANTA, GA. • BALTIMORE, MD. • *BIRMINGHAM, ALA. • *CHICAGO, ILL. • *CINCINNATI 37, OHIO • DALLAS, TEXAS • *DETROIT 3, MICH • GREENSBORO, N C • *LOS ANGELES, CALIF • *MIAMI, FLORIDA • *NEW ORLEANS, LA. • NEW YORK CITY, N Y • NEWTON CENTRE, MASS • *PHILA., PA • RICHMOND, VA. • ROCHESTER, N Y • SEATTLE, WASH. • ST. LOUIS, MO.

merely holding exploratory discussions on each type of procedure to develop the details and benefits of the various procedures available.

The bid depository system was described and discussed by Robert Munsie, executive director of the Associated General Contractors of Northeast Florida, Jacksonville. Under this system all subs must have their bids in to the depository four hours in advance of bid opening time. One of the biggest advantages of this system, Mr. Munsie said, was that "general" contractors are unable to check on the unknown or questionable bidders, whether or not they can be bonded, etc.

The NAPC Direct Bid Plan now in use by the National Association of Plumbing Contractors was presented and discussed by FAEC member Rudy Baacke, Standard Electric Co., Jacksonville. Under this plan, for mechanical contracts, the owner and architect accepts bids direct from the mechanical trades, Mr. Baacke explained. The final award decision is made by the owner, who can save as much as 20% by using this plan, it was claimed, as the "middleman," the general contractor, is eliminated. Under separate contracts, the owner can better analyze the costs of various work, and responsibility can be placed where it belongs, it was stated. The NAPC plan, known as the Separate Contract System, has been approved by the U. S. Courts, and can benefit both the general contractor and the mechanical contracting trades, it is contended.

Miller Brainerd of Sun Coast Contracting Co., Tampa-St.Petersburg area, described the PACE bid plan. PACE is not a trade association, Mr. Brainerd said, and its operation does not conflict with any group of bidders.

Under the PACE plan, all mechanical and electrical bids are opened 48 hours in advance of the general contractors' bids opening. Under this procedure, all bids are out in the open, and there is one bid and one price to all generals.

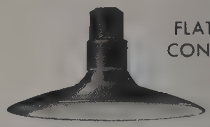
The following were elected to office for the 1961-62 fiscal year: President—Paul Foster, Foster Electric Co., Miami; 1st Vice President—John LaTour, Economy Electric Co., Daytona Beach; 2nd Vice President—Thomas B. Drage, United Electric Co., Jacksonville; Recording Secretary—Curtis Lee Futch, Brevard Electric Co., Titusville; Treasurer—James K. Scarborough, J & J Electric Co., Ocala; and Fin. Secy.—Vernon Holloway, Interstate Electric Co., Miami.

QUAD
REFLECTORS

Be Sure Always...
CHOOSE
the unit best suited for your lighting job—
FROM THESE 5 SHAPES

STANDARD DOME

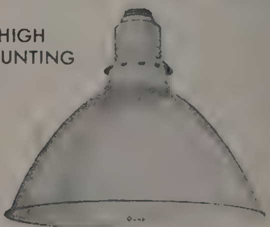
FLAT CONE



STOCKROOM

ANGLE

HIGH MOUNTING



WRITE FOR
CATALOG NO. 10
QUADRANGLE MFG. CO.
32 S. PEORIA ST.
CHICAGO 7, ILLINOIS

Correction

Two errors in the special editorial feature on "HEAT in LIGHTING," published in our October issue, have been brought to our attention. On page 91, in illustration at top of page, change Btu/hr for "Convection & conduction" from 102.6 to 125.6. Also, on page 92 in illustration in center of page, change "Total Btu/hr" for "Energy Confined in Luminaire" from 285.6 to 225.6.

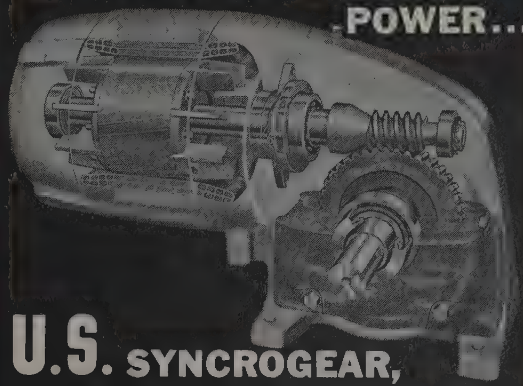
Modern Lighting Concepts Reviewed in Western Forum

The West's first major trade show to be devoted exclusively to the lighting field was staged October 3-5 in Hollywood, Calif., where numerous new lighting sources, fixtures and applications were presented in an effective exhibition, and where afternoon and evening forums explored such topics as multi-function ceilings, flexible lighting arrangements for obtaining psychological objectives, and case histories emphasizing relationship between good lighting and efficiency, moral, production and profit. Forums were conducted by recognized authorities such as Will S. Fisher, commercial lighting specialist, General Electric, Cleveland, Ohio; William F. Blitzer, vice president in charge of product development, Lightolier, Jersey City, N. J., and Milton Buzan, project engineer, Day-Brite Lighting, St. Louis, Mo.

The show, first of a planned annual series to be sponsored by the Electric League of Southern California, was favorably endorsed by delegates and exhibitors alike; those in attendance obtaining lighting information which was up-to-the-minute in timeliness; exhibitors having the attention of a selective, invitational professional audience which included southwestern contractors, consulting engineers, maintenance men, wholesalers, architects and decorators.

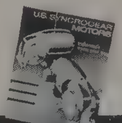
Multiple objectives of modern ceiling installations were targets for Will Fisher's remarks, who related lighting to air conditioning, fire prevention, sound systems and acoustics; declaring that these space-conditioning factors no longer could be considered as non-related entities in our present Space Age, and that combinations were now essential in order to obtain maximum efficiency, comfort and convenience.

COMPACT, SLOW-SPEED POWER...



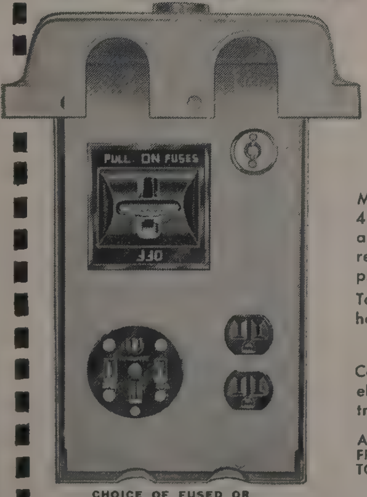
U.S. SYNCROGEAR, RIGHT-ANGLE WORM-GEAR TYPE
⅓, ½, ¾, 1, 1½, 2 h.p.

Many configurations... combinations... ratios
Ratios in Type GW shown, up to 87:1 (in double-reduction GWB, to 354:1) speeds 3.25 to 230 rpm. Variable-speeds, totally-enclosed, explosion-proof, single-phase, flange-mounted among other models available. Rugged, compact—the economy choice in slow-speed power! *Send for Bulletin F-1971*



U.S. ELECTRICAL MOTORS Inc.
Box 2058, Los Angeles 54, California—or Milford, Conn

Midwest
COMPLETELY WEATHERPROOF
U-L APPROVED
POWER OUTLETS
FOR FARMS, RANCHES, MOBILE HOME PARKS, INDUSTRY, OUTDOOR CONSTRUCTION!



CHOICE OF FUSED OR CIRCUIT BREAKER TYPES

MODEL P-55-F, as illustrated, has a 50 amp, 250 volt, 4 wire power receptacle, protected with a 2 pole, 60 amp pull out block. Also has a grounded type duplex receptacle protected with a separate fuse. U-L Approved!

Top hub and three KO's in bottom facilitate overhead or underground connections.

COMPLETELY TAMPERPROOF!

Cover closes when in use and can be padlocked to eliminate tampering. Also Model similar to one illustrated, with circuit breaker replacing the fuses.

A COMPLETE LINE OF STANDARD MODELS TO CHOOSE FROM IN FUSED OR CIRCUIT BREAKER TYPES WITH 15 TO 60 AMP, 3 and 4 WIRE RECEPTACLES.

OVER 100 DIFFERENT MODELS!

SEE YOUR LOCAL ELECTRICAL DISTRIBUTOR OR WRITE . . .
Midwest ELECTRIC PRODUCTS, INC. DEPT. EC
MANKATO, MINNESOTA

"Hi-RED"
PLASTIC EXPANDING
SCREW ANCHORS
HOLD . . .
HOLD . . .
HOLD
WHERE OTHERS FAIL!

ONLY
5¢ PER MOUNTING*
(Drill, anchor and screw)

*K-8 KIT

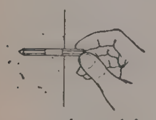
SAVE UP TO 70%

USE IN ANY MATERIAL YOU CAN DRILL: CONCRETE, STONE, CINDER BLOCK, BRICK, MORTAR, TILE, ETC.

MILLIONS IN USE!
(A REAL JOB-PROVEN ANCHOR)

"Hi-RED" anchors may be cut as needed for short screws

- Anchor costs less.
- Costs less to install —takes smaller hole . . . no tamping.
- Terrific holding power (P.T.L. ratings up to 4,180 lbs.)
- Sizes up to ½" lag screw.


. . . and used in tandem with long screws.

BUY 'EM IN BULK OR KITS!

FREE SAMPLES

SEND "Hi-RED" SAMPLES
NAME
FIRM
STREET
CITY STATE

Hi
TRADE MARK REG.
HOLUB INDUSTRIES, Inc.
442 ELM ST. • SYCAMORE, ILL.

In illustrating his talk, Fisher referred to light-related heat values pertaining to ballasts, convection, conduction and invisible radiation; maintaining that much of this heat is trapped or absorbed by ceilings and fixtures, but that 20% or more descends into space being illuminated, adding to space heat which increases air conditioning loads. He also showed that fluorescent light output diminishes as ambient temperatures in and around fixture areas increase above 77 degrees, concluding that dual benefits of more light and less room heat can be obtained when fixtures are designed as components of the over-all air conditioning system.

Various possibilities and methods for obtaining these objectives were then illustrated to show that use of water cavities, fins, double walls and induced air flow through lamp and ballast areas could lower heating, cooling and lighting costs.

Bill Blitzer's discussion was focused primarily upon lighting as a psychological or mood-creating medium in such applications as residential, hotel and institutional. Referring to the fact that ⅞ths of all impressions require sight, and that sight requires light, Blitzer showed how light could be regulated by switching and dimming, oriented by pulling fixtures up or down or moving them along tracks, or directed by aiming, shielding or focussing. Variations in color, intensity, concentration and placement of lights can also direct traffic or visual attention, allocate space or create moods of restfulness or tension, excitement or quiet, depending upon desired effects, size of rooms, number of people present or type of activity involved. Applications and effects were well illustrated by slides and sketches.

A third subject of interest was explored by Milt Buzan, who discussed case histories to prove that efficiency, production, morale and profits had improved when plants or offices had upgraded their lighting installations in accordance with higher recommended footcandle standards.

Lighting is an essential ingredient of industrial production, said Buzan, who added that higher levels of illumination were now obtainable with improved lamps, ballasts and fixture designs. Fixture manufacturers are learning more about designing fixture interiors so that light or dirt will not be trapped therein, while quality output on a lumen-per-watt basis is being increased constantly by higher-reflectance paints and enamels and better plastics.

Reviewing recent research projects that have scientifically justified higher levels of lighting in industry and commercial applications, Buzan added that management likewise is impressed with tangible results being obtained by upgrading their illumination, such as higher production, fewer rejects, greater accuracy, decreased absenteeism.

Numerous excellent slides illustrated how relighting projects had raised prevalent footcandle averages to 200-to-400 fc or higher, with certified benefits related directly to such modernization.

In addition to presenting numerous new lamps (square fluorescent, iodine, mercury) and fixtures (lensed, louvered, air conditioned), the conjunctional trade show featured flexible "ropes" of fluorescent plastic tubing which could be festooned for decorative purposes, panelescent "walls" of light, also a large scale illuminated fountain where "dancing" light resulted from changing color and water patterns. Low-voltage swimming pool fixtures, a comprehensive photometric instrument display, an interesting historic exhibit of ancient lamps, a portable washing machine for automatic cleaning of luminous ceiling panels, and new remote control modular switching elements likewise merited attention. Displays in this exhibition collectively constituted a connected electrical load of 350 kw.

The committee responsible for this exhibition-forum included Roy Kreyser, Los Angeles Dept. of Water & Power and I.E.S. Regional V.P.; Roy Dahlin, So. Calif. Edison Co.; Jack Rollins, representing N.E.C.A.; Mel G. Kennedy, representing the sponsoring Elec. League of So. Calif.; E. C. Herron from General Electric; Lou Barrett, Sylvania; S. W. Scott, Graybar; William Shalda of the Shalda Co.; P. R. Freeman, Sunbeam; N. A. Blumberg, Lightolier; R. H. Cockfield, Dept. W&P, and A. Howard Williams, exposition manager.

EASA News

A check of attendance figures at the two recent EASA Conventions, in San Francisco this year, and in Miami, in 1960, revealed that Illinois members were the most convention-minded, followed closely by Ohio.

If the penchant of Illinoisans to

D-C POWER

Up to 1500 Amperes

Over 200
Rectifier Power Supplies
Automatic Battery Chargers
in these 6 Types

SILICON CONTROLLED RECTIFIER

TRANSISTOR-MAGNETIC AMPLIFIER

MAGNETIC AMPLIFIER (STAVOLT)

UNREGULATED AND SEMI-REGULATED (RECTODYNE)

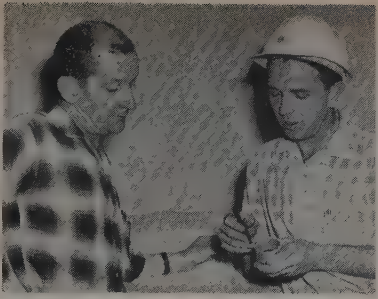
ALL TRANSISTOR

AUTOMATIC BATTERY CHARGERS FOR EVERY TYPE OF BATTERY

CHRISTIE®

Write for Complete Information

CHRISTIE ELECTRIC CORP.
3412H West 67th Street
Los Angeles 43, California



BILL LOUDEN, job superintendent for Fischbach and Moore on mammoth Los Angeles airport expansion project, pays close attention to general foreman Chris Ferrick, while latter explains characteristics of special core bit used to drill through "green" reinforced concrete decks of new passenger terminals.

travel great distances to join in the annual three-day affairs continues, the 1962 convention, to be held next June in Chicago, should break all records.

Illinois and Ohio are not the only convention-conscious EASA states, of course. New York, Texas, Pennsylvania, and Massachusetts also made good showings in the survey of attendance. Probably the record number of group miles was set by Canadian members who showed up in large numbers at both conventions these last two years despite the long distances involved.

• • • •

Another series of electronic motor control courses will be held for EASA shop employees next year, the association's Engineering Committee Chairman Walter Brush has announced. Basic courses similar to the ones held in various cities throughout the United States early this year are scheduled for Cleveland, Ohio, January 8-12; Houston, Texas, January 29-February 2; and Seattle, Wash., February 12-16.

In addition, there will be another series of courses for advanced students. These will be held in New York City, March 12-14; Chicago, Ill., April 9-14; Atlanta, Ga., April 23-25; Dallas, Texas, May 7-9; and San Francisco, Calif., May 21-23. Advanced courses are of three days' duration while the basic courses last five days each.

Information about enrollment fees and reservations may be obtained from EASA Headquarters, 7730 Carondelet Ave., St. Louis 5, Mo.

• • • •

Electrical apparatus service shop owners were given suggestions for better management by a member of the St. Louis University School of Commerce and Finance faculty at

Hi ...THE COMPLETE QUALITY LINE OF
CONDUIT and PIPE CLAMPS

NEW

• "TWO-HOLE" SNAP STRAPS
Made of semi-spring steel! They snap on... free both hands for nailing. Cost no more than ordinary straps... easier to use, stay on tight. Rust-resistant! Size and type stamped on every strap. TYPE 1 for E.M.T. and other thinwall conduit. TYPE 2: for rigid conduit and pipe.

• "ONE-HOLE" SNAP STRAPS
Bump inside strap holds strap firmly on pipe . . . makes difficult installations easier. Rust-resistant! TWO TYPES: for thinwall . . . and rigid conduit and pipe. Size stamped on every strap.

• DRIVE-STRAPS
2-TYPES FOR MASONRY OR WOOD
DRIVE 'EM LIKE NAILS... Never loosen . . . Won't break! Made of strong steel... electroplated! Two types: Verticle Thread for masonry; Annular Thread for wood. Sold in kits and cartons. Sizes ½", ¾" & 1".

• LOOP-TYPE PLASTIC CLAMPS
Many uses as a clamp—strain relief—clip hanger—fastener—strap. CUT COSTS . . . safe . . . last longer . . . no corrosion. Made in 4 materials: Polypropylene, Ethyl Cellulose, Nylon and Saran.

• PLASTIC STRAPS, non-corrosive, 2-hole type. 3 sizes.

• NEW PERFORATED HANGER STRAP
Three finishes: Plain—Galvanized—Copper Coated. Made of best quality steel, 20 ga. x ¾", 10' and 100' coils. Attractive display carton contains 24 single boxed coils.

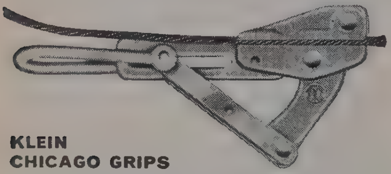
WRITE FOR NEW "HI" CATALOG
NAME ____
FIRM ____
ADDRESS ____
CITY ____ STATE ____

Hi HOLUB INDUSTRIES, Inc.
442 ELM ST. • SYCAMORE, ILL.

FOR THE LONG, HARD PULL

Whether it is a block and tackle, grips or snaps, you will find a wide variety illustrated and described in the Klein Catalog.

Klein equipment is specially designed for the tough, hard use that it receives in stringing power or communication lines. Grips, hooks, snaps are all drop-forged in Klein's own forge shop to assure maximum strength. All equipment tested to stand loads in excess of safe load indicated.



KLEIN CHICAGO GRIPS

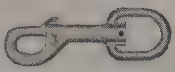
This family of grips suitable for bare wire, solid or strand. You will find a complete selection of grips for every type of conductor in the Klein Catalog. Jaw length and design of groove combine to eliminate conductor damage.

No. 1628-5—available with plain jaws or bronze-lined jaws. Maximum openings from .198 to .522 inch.

SELF-LOCKING BLOCK TACKLE

One of a specialty line of Klein block tackles with steel shell blocks and drop-forged hook. Rope is of highest quality Manila. Safe load, 1200 lb.

No. 1802-30 furnished with detachable hook, as shown. No. 1802-30S furnished with detachable swivel anchor hook.



SWIVEL HAND LINE SNAP

The only drop-forged snap of this type on the market. Has swivel clevis and quick-acting plunger latch. Will take ½-inch or lighter hand lines. Safe load, 750 lbs. No. 470.

FREE TOOL GUIDE

Write for 103TG Tool Guide covering complete Klein line.

ASK YOUR SUPPLIER

Foreign Dist: International Standard Electric Corp., N. Y.

Mathias KLEIN & Sons
INCORPORATED
7200 McCORMICK ROAD, CHICAGO 45, ILL.

a recent meeting of the association's Midwestern Chapter, in Omaha, Neb. Said Dr. Jack Wolfe: "Improve availability; practice empathy; prospect for customers regularly; trade on your specialization; follow-up; teach employees human relations; keep records and practice reciprocity."

Dr. Wolfe is a member of the EASA Management Seminar team.

• • • •

Sixty-seven members, including 20 wives, were at the Mid-South Chapter meeting at Loret Lake Resort, Chattanooga, Tenn., on September 14. EASA executive vice-president A. A. Baechle; John Gray, Allis-Chalmers Co.; and Chester Turnbaugh, P. R. Mallory Co., were among the speakers.

• • • •

Another large group of Easans was on hand for the fall meeting of the North Central Chapter in Duluth, Minn. Members toured the taconite plant of the Reserve Mining Co. and the Mielke Electric Works.

• • • •

The fall meeting of the Southwestern Chapter of EASA was held on October 5-7 at Lake Texoma Lodge. Speakers were Roctor Swearengin, Lake Texoma Association; George Larsen, EASA president; J. C. Hardie Jr., Industrial Electric & Equipment Co., Dallas, Texas; Milt Bockman, Prudential Insurance Co., Fort Worth, Texas; and J. E. Jackson, W. W. Smith Electric Co., Dallas.

• • • •

Electric Motor Repair Co. and Electric Motors Unlimited were cohosts at the September 19 meeting of Wisconsin Chapter in Madison.

• • • •

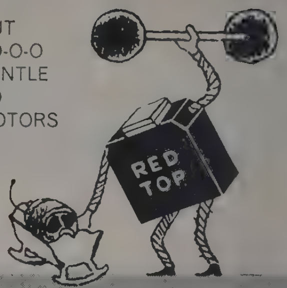
A national EASA membership drive has been announced by membership chairman Earl S. Brooks, Seattle, Wash. $150 in prizes will be awarded to the EASA chapter showing the greatest percentage increase in membership at the end of the association's fiscal year next March 31.

• • • •

A new building has been opened by Jack's Electric Motor Co., Fort Lauderdale, Fla. . . . Holt Electric Co., of Milwaukee, Wis., has modernized its building with a new front and sign. . . . Two prominent EASA boosters, George Brown, Essex Wire Corp., and J. Ray Horton, former owner, Daley Electric Co., Phoenix, Ariz., have formed the B&H Wire & Insulation Co. with headquarters in Phoenix and a branch warehouse in Arlington, Texas.

RUGGED

BUT SO-O-O GENTLE TO MOTORS

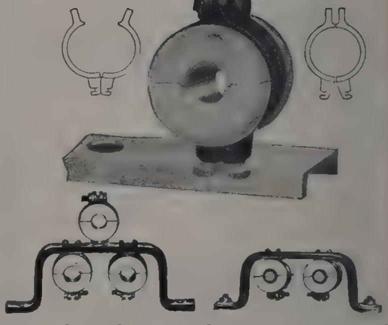


HELWIG
RED TOP
CARBON BRUSHES

Highest quality **HELWIG** brushes are easy to install, wear evenly, give even current distribution. Exclusive Red Top absorbs vibration for better commutation, longer brush life, minimum commutator maintenance.

HELWIG CARBON PRODUCTS, INC.
2544 North 30th Street, Milwaukee 10, Wisconsin

FOR QUICK, EASY
Cable Installation
"EFFICIENCY"
NESTED CONDUCTOR RACKS



Nested conductor racks are compact and scientifically designed to carry cables equidistant from center to center. Available in 2, 3, 4, 5 and 6 bushing racks.

EFFICIENCY
ELECTRIC & MFG. CO.
EAST PALESTINE, OHIO

YOU ASKED FOR IT—

the May 1960 feature section of Electrical Construction and Maintenance now in a handsome hard-cover book.

CONSTRUCTING ELECTRICAL SYSTEMS

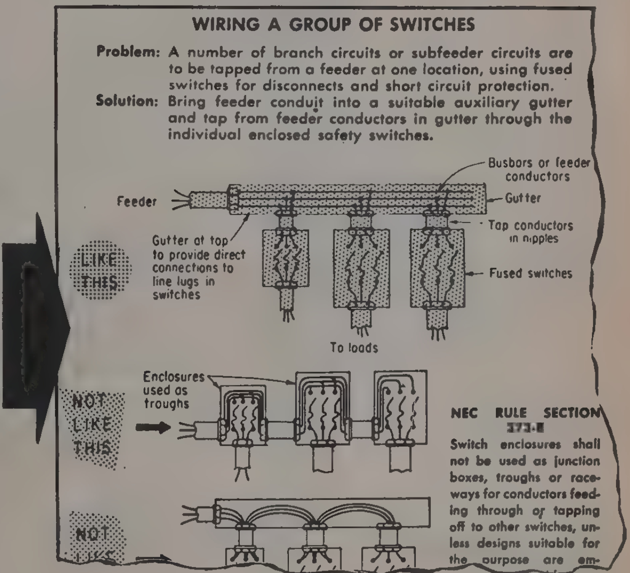
by J. F. McPartland and the Editors of Electrical Construction and Maintenance

Here's a modern, comprehensive reference and instruction manual on the methods and techniques used in constructing systems for power, light, signals and communications. Covering the best practice on selecting, mounting, connecting and housing all types of electrical equipment, **this manual presents *1959 National Electrical Code data* relating to installation. And a wealth of special illustrations are used throughout to clarify fine code points.**

Chapters are broken down on the basis of types of equipment to facilitate ready reference: lighting equipment — motors and controllers — conductors — raceways — switches — overcurrent protective devices — switchboards and panelboards — transformers — capacitors and regulators — power sources — high voltage — signals and communications.

CONTRACTORS — Get copies of this book for your job superintendents, foremen and estimators. They'll appreciate the gesture and you'll get a high return on your investment.

ENGINEERS — This book is a bonanza of information in the area where electrical design encounters most difficulty. Get copies for your key designers, junior engineers and draftsmen working into design.



WIRING A GROUP OF SWITCHES

Problem: A number of branch circuits or subfeeder circuits are to be tapped from a feeder at one location, using fused switches for disconnects and short circuit protection.

Solution: Bring feeder conduit into a suitable auxiliary gutter and tap from feeder conductors in gutter through the individual enclosed safety switches.

NEC RULE SECTION 373-8

Switch enclosures shall not be used as junction boxes, troughs or raceways for conductors feeding through or tapping off to other switches, unless designs suitable for the purpose are em-

Busbars or feeder conductors
Feeder
Gutter
Tap conductors in nipples
LIKE THIS
Gutter at top to provide direct connections to line lugs in switches
Fused switches
To loads
Enclosures used as troughs
NOT LIKE THIS
NOT

PLANT ELECTRICAL PEOPLE — This book should be in the reference library of plant electrical engineers, electrical supervisors and electricians.

ELECTRICAL INSPECTORS — Here's a unique presentation of code rules in combination with specific installation details taken from modern practice. The correlation between code generalities and actual job specifics will assist inspectors in many difficult rulings.

CONTENTS

- General Considerations
- Luminaires and Lighting Equipment
- Motors and Controllers
- Conductors
- Raceways
- Switches
- Overcurrent Protective Devices
- Switchboards and Panelboards
- Transformers
- Capacitors and Regulators
- Power Sources
- High Voltage
- Signals & Communications

USE THIS COUPON TO ORDER YOUR BOOK

PLEASE PRINT

"CONSTRUCTING ELECTRICAL SYSTEMS"
Electrical Construction and Maintenance
330 West 42nd Street, New York 36, N.Y.

Please send me ____ copy (copies) of the book, "Constructing Electrical Systems," at $4.50 each.

☐ Payment enclosed. ☐ Please bill me. ☐ Bill Company.

Ship to:
Name________________ Title__________

Company Name____________________

Address — Home ☐ Company ☐ ________________

City__________ Zone____ State________

Please indicate nature of Co. business________________

(273-076)

Load-Break Dependability is the third of three important requirements for Service Entrance switches. The first two: Electro-Mechanical Strength and Operating Performance. Be sure the switch you specify exceeds all in-service requirements in these basic areas.

Extensive tests were run on the Pringle LOAD BREAK Switch to prove its reliability. Example of Load-Break Dependability: Switch opened and closed against 15,000A. 510V. — no damage to the switch! Also, switch opened 22,000A. 510V. — again no switch damage.

Get the full detailed report. Just write for Test Report Bulletin P-112.

Pringle ELECTRICAL MANUFACTURING COMPANY

1906 N. SIXTH ST., PHILADELPHIA 22, PA.

DATES AHEAD

National Electrical Manufacturers Assn.—Annual meeting, Traymore Hotel, Atlantic City, N. J., November 13-17.

International Association of Electrical Inspectors—Canadian Section, King Edward Hotel, Toronto, Ont., November 17-18; **Illinois,** Morrison Hotel, Chicago, Ill., February 1-2; **Joint Five Chapters,** Shreveport, La., April 27-28; **Virginia Chapter,** John Marshall Hotel, Richmond, Va., June 18-19; **Southern Section,** Tutwiler Hotel, Birmingham, Ala., October 18-19.

Plant Engineering & Maintenance Show—Convention Hall, Philadelphia, Pa., January 22-25, 1962.

Power & Communications Controls Assn.—17th annual convention, Atlanta Biltmore Hotel, Atlanta, Ga., January 28-30.

American Institute of Electric Engineers—Winter general meeting, Statler-Hilton Hotel and Coliseum, New York, N. Y., January 28-February 2.

Electrical Engineering Exposition—Sponsored by AIEE, New York Coliseum, New York, N. Y., January 29-February 2.

American Society of Heating, Refrigeration, & Air Conditioning Engineers, Inc.—Semiannual meeting, Chase Park Plaza Hotel, St. Louis, Mo., January 29-February 1; 69th annual meeting, Deauville Hotel, Miami Beach, Fla., June 25-27.

Home Improvement Products Show—Cobo Hall, Detroit, Mich., January 31-February 2.

National Industrial Electric Heating Conference—Netherland-Hilton Hotel, Cincinnati, Ohio, February 5-8.

Intermountain Electrical Assn.—Annual conference, Salt Lake City, Utah, February 8.

National Electrical Week—National promotion, February 11-17.

Air Conditioning, Heating, and Refrigeration Industry—12th exposition, Great Western Exhibit Center, Los Angeles, Calif., February 12-15.

Upper Midwest Electrical Industry Convention — Radisson Hotel and Municipal Aud., Minneapolis, Minn., February 18-21.

National Conference on Application of Electrical Insulation—Shoreham Hotel, Washington, D.C., February 19-21.

18th Annual National Wiring Sales Conference—Atlanta-Biltmore, Atlanta, Ga., February 21-22.

Sacramento Valley Electrical League—Progress in Electrical Equipment Exhibit, Sacramento Inn, Sacramento, Calif., February 28-March 2.

National Rural Electric Cooperative Assn.—20th annual meeting, Convention Hall, Atlantic City, N. J., March 5-8.

TESTS PROVE:
10% more slip
with
Y-ER EAS
Wire Pulling Lubricant
For Lead, Rubber, Braid or Synthetic Covered Cables

There is only one Y-ER EAS

Don't accept substitutes. The extra slip means extra savings on every job.

- Creamy, non-corrosive. Never greasy or messy.
- Prevents sticking or setting. Extra slip for saddles and turns.
- Does not run back on cables.
- Never harmful to hands, clothing, cables or conduit.

NEW! ALUM-N-EAS
Thread lubricant stops binding of aluminum conduit connections!

Write for descriptive literature

UL

At all Leading Electrical Supply Houses

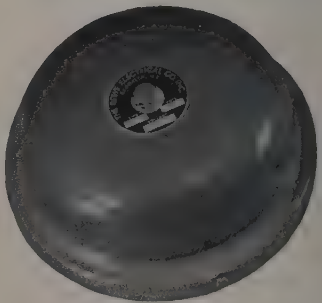
ELECTRO COMPOUND CO.
4149 W. 150th St., Cleveland 35, Ohio

BELLS

for all types of installations

Single stroke or vibrating

in all voltages—DC 6 to 220 v. AC 6 to 250 v. in sizes from 3" to 12"



For all telephone or alarm systems. Housings of sturdy cast aluminum with excellent clarity and high decibel output. Underwriters Laboratories listed. Also a full line of cow bells and buzzers.

Write for literature
HOSE-McCANN
TELEPHONE CO., INC.
25th St. & 3rd Ave., Brooklyn 32, N.Y.

Sixth National Electrical Industries Show—New York Coliseum, New York, N. Y., March 11-14.

2nd NEMA National Electric Comfort Heating Exposition and Symposium—Sherman Hotel, Chicago, Ill., March 19-21.

11th Biennial Electrical Industry Show & Lighting Conference—Shrine Exposition Hall, Los Angeles, Calif., March 28-31.

Edison Electric Institute—Sales conference, Edgewater Beach Hotel, Chicago, Ill., April 2-4.

Electrical Association of New Orleans Southern Electrical Exposition—Municipal Auditorium, New Orleans, La., April 2-4.

Southern West Virginia Home Show—Civic Center, Charleston, W. Va., April 4-8.

Rocky Mountain Electrical League—Spring conference, Harvest House, Boulder, Colo., April 15-17; fall convention, The Broadmoor, Colorado Springs, Colorado, October 14-18.

National Association of Electrical Distributors—Convention, Pittsburgh, Pa., May 12-16.

Pacific Coast Electrical Assn.—Annual convention, Ambassador Hotel, Los Angeles, Calif., May 16-18.

National Fire Protection Association 66th annual meeting, Sheraton Hotel, Philadelphia, Pa., May 21-25.

Edison Electric Institute—Annual convention, Atlantic City, N. J., June 4-6.

Electrical Apparatus Service Association—Convention, Conrad-Hilton Hotel, Chicago, Ill., June 10-13.

Los Angeles Home Show—Memorial Sports Arena, Los Angeles, Calif., June 21-July 1.

N. Y. State Assn. of Electrical Contractors & Dealers—Annual convention, Whiteface Inn, Lake Placid, N. Y., July 2-7.

Western Electronic Show & Convention—Memorial Sports Arena, Los Angeles, Calif., August 21-24.

American Home Lighting Fixture Month—National promotion, September 1-30.

Illuminating Engineering Society—National technical conference, Statler-Hilton Hotel, Dallas, Texas, September 9-14.

Canadian Electrical Mfrs. Assn.—Annual meeting, Sheraton-Brock Hotel, Niagara Falls, Ont., October 3-5.

International Assn. of Electrical Leagues—27th annual conference, Sheraton-Chicago, Chicago, Ill., October 3-5.

National Electrical Contractors Assn.—Minneapolis Auditorium, Minneapolis, Minn., October 7-13.

National Electronics Conference—McCormick Place, Chicago, Ill., October 8-10.

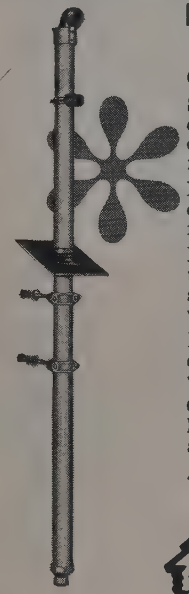
National Electrical Manufacturers Assn.—Annual meeting, Shoreham Hotel, Washington, D. C., week of November 12.

Before you buy . . .

COMPARE*

BLACKHAWK SERVICE ENTRANCE MAST

builds your reputation for quality and service



Check these fittings against any others on the market.

Slip-fitter service entrance head — Just slip it on over conduit and tighten two set screws. That's all. Made of corrosion-resistant aluminum. Available in a full range of sizes.

Insulators — Reinforced, durable, well-rounded porcelain secured to metal pipe mounting clamp, galvanized pull-off fitting available uninsulated.

Flexible Synroflashing — Made of flexible neoprene to absorb vibration. Mast can't work loose, damage shingles or cause leaks. Won't rot, peel or crack in any weather. Available for 1¼, 1½, 2, 2½ and 3" pipe.

MOUNTING BRACKETS — New combination bracket accommodates 1¼, 1½, 2, 2½, and 3" pipe. Available with ½" thru bolts or with lag screws.

OFFSET REDUCER — Corrosion-resistant aluminum alloy. Fits 1¼" and 1½" hubs to a 2" or 2½" pipe riser and 2" hub to 3" pipe riser.

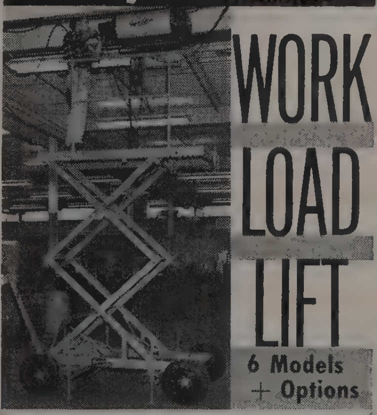
Available as a complete kit or as separate fittings.

Blackhawk Industries

Where the new ideas come from

DUBUQUE, IOWA

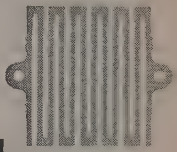
PORTABLE **Sky Witch** HYDRAULIC



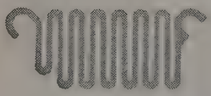
Lifts Men and Materials to Working Height . . . FAST!

Work height is easily changed up or down by a touch of the hydraulic controls, after releasing the safety lock. The big Sky Witch lifts loads of up to 2000 pounds and extends to heights of up to 30 feet —and there are models to fit other requirements! Ideal for installing and servicing overhead electrical systems! Offered in your choice of power, mounting, and optional features!

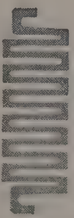
CHARLES Machine Works, Inc.
626 Birch St. • Perry, Okla. • FE 6-4404



CAST IRON GRID RESISTORS?



more than 130 types and styles available from our complete stock



Quality controlled castings, close grained, smooth and strong. Bosses ground automatically to close tolerances for proper contact.

The **A. C. WILLIAMS** Co.

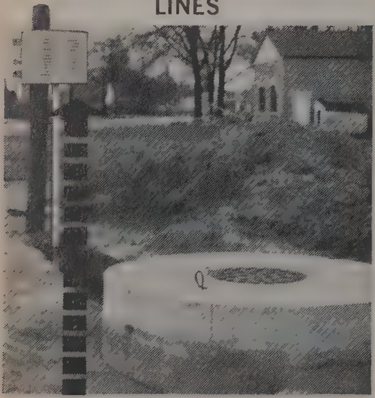
Since 1844 • Ravenna, Ohio

Complete Pattern Facilities; All Grades of Gray Iron Plus Aluminum and Magnesium Castings of Aircraft Quality

* "MARKETS UNLIMITED" *

SEWAGE LIFT STATION OPERATES . . .

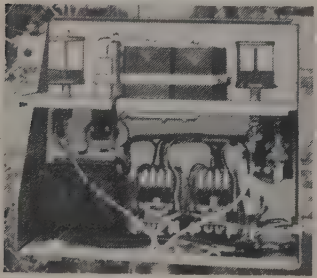
3-PHASE FROM SINGLE PHASE LINES



"DUO" Add-A-Phase®

POWER CONVERTER

- Single Compact Unit Operates Both Pump Motors
- Full Horsepower Rated Load
- Near Unity Power Factor
- Eliminates 3 Phase Cost



Write For More Information

ADD-A-PHASE ECM-11
Div. System Analyzer Corp., Nokomis, Illinois
Gentlemen: Please send, without obligation, complete details on your ADD-A-PHASE Power Converter.
Name______________Title______________
Company______________
Address______________
City______________Zone______________
State______________

SEE FOR YOURSELF . . . package includes many case histories of the success of the Add-A-Phase . . . years of trouble free use. IF YOU HAVE A SPECIFIC ELECTRIC POWER PROBLEM GIVE US THE DETAILS FOR RECOMMENDATION.

Among the Manufacturers

Headquarters Announcements

General Electric Co. has merged its Small Integral Motor Dept. of Fort Wayne, Ind., with its Small AC Motor and Generator Dept. of Schenectady. Bryce W. Wyman will continue as general manager.

International Resistance Co., Philadelphia, Pa.—David E. McElroy, manager of new Chemical, Material & Process Engineering Dept.

Hazard Controls, Inc., Delair, N. J.—James C. Johnston, vice president.

General Electric Co., Schenectady, N. Y.—Theodore L. Etherington, manager of advance engineering, Outdoor Lighting Dept.

Anaconda Wire & Cable Co., Hastings-on-Hudson, N. Y.—Austin W. Dunham, manager of new Utility Products Div.

Black & Decker Mfg. Co., Towson, Md.—G. Harvey Porter, director of marketing services; Joseph H. Schmidt, Jr., general sales manager, Consumer Products Div.

Hubbard and Co., Lyons, Ill.—George C. Wright, marketing manager.

Controls Co. of America, Schiller Park, Ill.—George D. Becker, group vice president; A. L. Topp, general manager, Heating and Air Conditioning Div. and vice president of corporation.

G&W Electric Specialty Co., Blue Island, Ill.—C. E. Bitzer, vice president of marketing.

Sterling Electric Motors, Inc., Los Angeles, Calif.—Alfred E. Grazen, president and general manager.

Corning Glass Works, Corning, N. Y.—William T. Cahill, product specialist in lamp parts, Lighting Glassware Marketing Dept.

Crouse-Hinds Co., Syracuse, N. Y.—Arthur F. Uhrlandt, director of marketing; F. William Oberle, director of sales; Marketing Div.

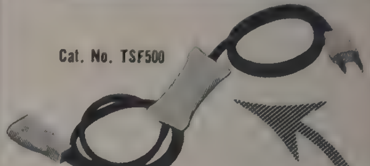
Omark Industries, Inc., Portland, Ore.—David G. Bogue, merchandising manager; Paul J. O'Herron, field sales manager; Richard B. Lewis, chief engineer.

Day-Brite Lighting Inc., St. Louis, Mo.—George J. Kennedy, general sales manager.

Federal Pacific Electric Co., Newark, N. J.—Three new commercial vice presidents: Harry W. Ashman, manager of Government

Low Cost

FIXED TEMPERATURE THERMOSTAT



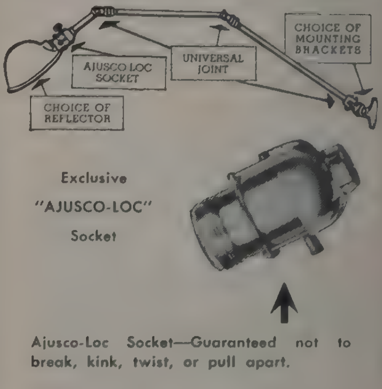
FOR 120 and 240 VAC

Highly successful surface sensitive pre-set thermostat made of quality materials. U/L and CSA approved switch. Factory calibrated to operate above freezing. For automatic operation of any heating device up to 500 watts on 120 VAC or 1,000 watts on 240 VAC. Sealed waterproof. Has 4-ft. cord, plug and single outlet. Only $4.45.

Write for FREE Literature

THE SMITH-GATES CORP.
FARMINGTON, CONN.

LOCAL LIGHTING
FOR MACHINE AND BENCH
Easy to Use—Hard to Damage



Ajusco-Loc Socket—Guaranteed not to break, kink, twist, or pull apart.

Put the light where you want it and it stays there—no sagging or slipping. Eliminate costly repairs and lost time with these fixtures that stay on the job and out of the repair shop.

Write today for Catalog 66
There's a "right" fixture for every job.

Adjustable FIXTURE CO.
Established 1911
104-108 E. Mason St., Milwaukee 2, Wis.

sales and contracts; Armond J. Bisignani, Jr., manager of mixed-apparatus contracts; and B. S. Burke, manager of Central Region; Joseph A. Sevigny, marketing manager for power capacitors.

Worthington Corp., Harrison, N. J.—Ed B. Hunter, manager of production planning and material control, Harrison Div.

Electric Autolite Co., Toledo, Ohio—Donald M. Brown, product manager, electrical products group.

Sola Electric Co., Elk Grove Village, Ill.—Richard L. Jandl, vice president and general sales manager.

Stanley Works, New Britain, Conn.—William H. Wishart, sales manager, and Leslie H. Gillette, marketing manager, industrial hardware.

Owatonna Tool Co., Owatonna, Minn.—Richard Schuster, advertising and sales promotion manager.

Standard Tool & Mfg. Co., Lyndhurst, N. J.—Z. E. Zilahy, director of Contract Engineering Div.

Sigma Instruments, Inc., South Braintree, Mass. — Ralph S. Thompson, vice president, manufacturing; Robert H. Pierce, vice president, engineering; Philip Garnick, vice president, sales.

Lehrolite, Inc., Wallingford, Conn.—Louis Rosenblatt, president and chairman of the board.

Regional Appointments

NEW ENGLAND

Consolidated Pipe Co. of America: Jerry Fields, Norwalk, Conn., sales representative in Connecticut.

MIDDLE ATLANTIC

Consolidated Pipe Co. of America: Goodman Sales Co., Harrison, N. J., sales representative in northern New Jersey and a section of New York including Orange, Sullivan and Rockland Counties and Staten Island; Herman J. Saffer, Brooklyn, N. Y., sales representative for Metropolitan New York and Westchester County.

Sunbeam Lighting Co.: Judd Kaye, Clifton, N. J., sales representative in northern New Jersey.

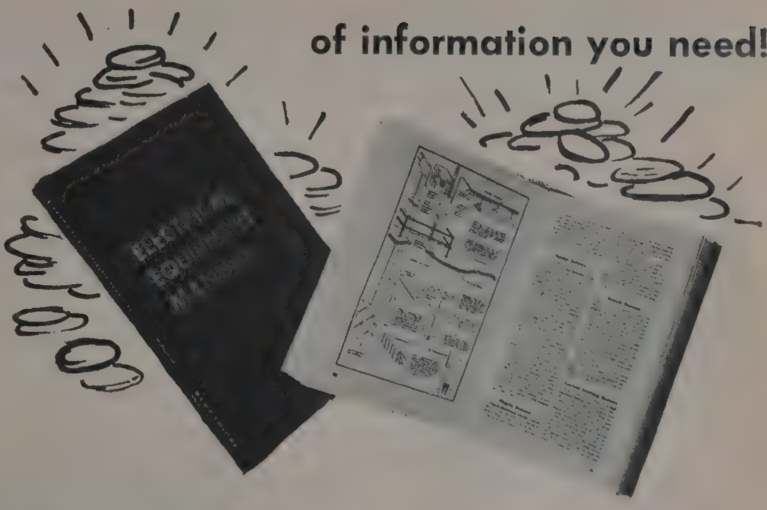
Sylvania Electric Products Inc.: Hall L. Simmers, sales manager of Pittsburgh district, and H. Page Woodbury, sales manager of Philadelphia district, Lighting Products Div.

Air Reduction Sales Co.: C. J. Langley, manager of Philadelphia district.

Briegel Method Tool Co.: Dale

A GOLD MINE . . .

of information you need!



Stake your claim for $4.50

ELECTRICAL EQUIPMENT MANUAL

Second Edition

by J. F. McPartland and W. J. Novak

Here's a 239-page, completely indexed, hard cover book.
Everyday, easy-to-use data on

- Lamps
- Lighting Fixtures
- Air Conditioners
- Heaters
- Generators
- Sound Systems
- Motors
- Wire and Cable
- Transformers
- Capacitors
- Protective Devices
- Switchboards & Panelboards
- Motor Controls
- Wiring Devices
- Switches
- Relays
- Pole Line Equipment
- Raceways and Busways
- Insulating Materials
- Explosion-proof Equipment
- Batteries and Chargers
- Grounding Devices
- Time Switches
- Signals and Clock Systems
- Industrial Electronics
- Closed-circuit Television
- Tools
- Meters and Testers

Designed for use as an instruction manual or as a reference text . . . aimed at the practical interests of —

- Electrical Contractors
- Electricians
- Estimators
- Electrical Inspectors
- Consulting Engineers
- Plant Engineers

GET your copy today! The only book of its kind, it contains UP-TO-DATE installation and application data, highlighting the best of modern circuits in which equipment is used. This book guides you in selecting the right equipment and materials for every job. The unique format is designed to provide ready answers to specific questions.

Electrical Wholesaling
Dept. 270-059
330 West 42nd St.,
New York 36, N.Y.

Please send me_____copies of the sturdily-bound, 239-page book "Electrical Equipment Manual" at $4.50 per copy ($3.75 per copy for orders of 50 or more).
Enclosed is full payment of $_____

PLEASE PRINT

NAME____________________

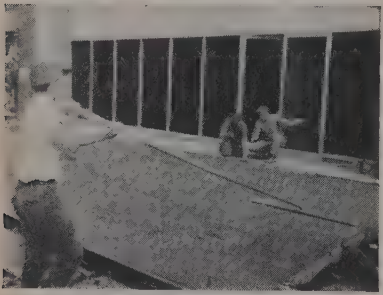
ADDRESS____________________

CITY____________ STATE____________

COMPANY NAME AND ADDRESS____________________

Pre-assembled, electrical
Sno-Melter speeds
South Bend sidewalk job!

As concrete crews poured and spread, electricians quickly rolled out 4½′ x 12′ Sno-Melter mats* right behind them.



While concrete sections were leveled, well-tagged Sno-Melter lead wires were fed into pre-arranged junction boxes.

Electricians were well out of the way by the time top 1½″ layer of concrete was poured. No wonder job went so fast!

Next winter, no more snow to shovel! Pre-assembled electrical Sno-Melters assured a fast, trouble-free job on this walk in front of the new offices of Albert McGann Securities Co., South Bend, Ind. Sno-Melters *roll right out as concrete is poured* for walks, drives, ramps, docks. Write for engineering data and catalog.

*Special Sizes

EASY-HEAT INC.
"Electric Snow Removal Equipment"
Dept. ECM, New Carlisle, Indiana

Theesfeld, Eastern Division sales manager.

Crouse-Hinds Co.: Gordon V. Miller, divisional manager for Northeast division, headquarters in New York City.

SOUTH ATLANTIC

Sunbeam Lighting Co.: Reid Trapani, Atlanta, sales representative for Georgia and eastern half of Tennessee.

Progress Mfg. Co.: Ernest T. H. Bowen, sales representative in North and South Carolina with headquarters in Charlotte, N. C.

General Electric Co.: Charles J. Ellis, Southeastern regional vice president, with headquarters in Atlanta.

Slater Electric Inc.: Henry Lennon, manufacturer's representative for Maryland, parts of Virginia and District of Columbia with headquarters in Baltimore; Wiring Device Div.

EAST CENTRAL

Wheelock Signals, Inc.: Emory Design & Equipment Co., Birmingham, sales representative.

Wagner Electric Corp.: Herbert P. Pillisch, manager of Indianapolis office; Electrical Apparatus Div.

General Electric Co.: Neil E. Billman, East Central district sales representative headquartered in Oak Park, Mich.; Silicone Products Dept.

Slater Electric Inc.: Kenneth Weiss, midwest manager for new office and warehouse in Chicago.

Wesix Electric Heater Co.: Ernest C. Winfree, Jr., Birmingham, manufacturer's representative in Alabama and northern Florida.

WEST CENTRAL

Wesix Electric Heater Co.: Charles V. Dunn Associates, Kansas City, manufacturer's representative; C. C. Koerner, St. Louis, manufacturer's representative in eastern Missouri and southern Illinois.

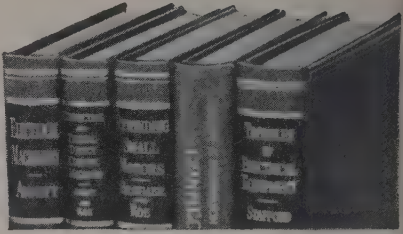
Slater Electric Inc.: Duke-Philibert & Co., New Orleans, manufacturer's representative for Mississippi and Louisiana.

Wagner Electric Corp.: Preston F. Ryan, manager of St. Louis sales office, Electrical Apparatus Div.

Sunbeam Lighting Co.: Chick Young, Little Rock, sales representative for Arkansas and Memphis, Tenn.

Edwards Co., Inc.: Gaylen G. Marshall, North Central district manager for North and South

Go after the
BIG MONEY
in electrical maintenance and repair



Keeping industrial and domestic electrical machinery "going" is a big-paying job for thousands of men—big today—and ever-growing, in this electrical age! Get into this promising line—grow with it into bigger opportunities and get really worth-while pay. Let this tested, practical set of books show you how—as it has hundreds of other men.

Electrical Maintenance and Repair Library

5 volumes 2079 pages 1884 illustrations

This Library starts you right at the beginning and takes you, step-by-step, through every phase of connecting, altering, testing, and repairing all types of electrical equipment. It shows you how to install motors and generators, and rewind motors—how to inspect and repair starters—locate trouble—test induction motors—and MUCH MORE! Hundreds of diagrams make everything crystal-clear. Here are the best on-the-job practices of the experts that will help to put you in the big-pay class—and rate you as an EXPERT electrical worker!

Includes trouble-shooting book

Worth the price of the entire Library alone is the 3rd Edition of Stafford's **Troubles of Electrical Equipment**, a handy book giving helpful maintenance information, special trouble-shooting charts, explanations of symptoms and causes of machinery troubles, and specific remedies—all designed to help you get those bigger electrical jobs done faster, more efficiently.

SAVE $8.00
Pay for Library while you use it

LOW PRICE—EASY TERMS

Bought one at a time, the books in this Library would cost $47.50. Here they are offered at a saving of $8.00 with the advantages of easy monthly terms and the right to examine the complete Library for 10 days without obligation.

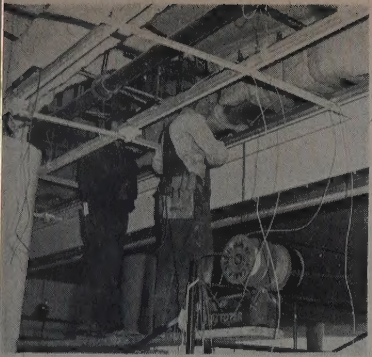
10-DAY FREE TRIAL

McGraw-Hill Book Co., Dept. EC-11
327 W. 41st St., New York 36, N. Y.

Send me for 10 days' examination the *Library of Electrical Maintenance and Repair*. If satisfactory I will send $7.50 in 10 days and $8.00 monthly until the price of $39.50 is paid. Otherwise, I will return the books postpaid.

Print Name ....
Address ....
City ....Zone ....State.......
Company ....
Position ....

For price and terms outside U. S. write McGraw-Hill Int'l., N. Y. C. EC-11



HIGH OVERHEAD does not worry Lew Cunningham or (peering from the shadows) Ed Mellin, who wired, lighting components above suspended metal cellular ceiling in section of new Los Angeles airport terminal.

Dakota, Minnesota, Kansas, Nebraska, Colorado, Wyoming, and western Wisconsin, Iowa and Missouri.

I-T-E Circuit Breaker Co.: Charles L. Roberts, manager of Minneapolis district office, Power Apparatus Group.

Penn-Union Electric Corp.: Delta Materials, Inc., New Orleans, agent for Louisiana and Mississippi; Mid-South Associates, Little Rock, agent for Arkansas and western Tennessee.

WEST

Collyer Insulated Wire Co.: A. A. Gingell Co., San Francisco, representative for northern California and Nevada.

Corning Glass Works: Jerrold R. Bucher, western district sales manager, located in Anaheim, Calif.

Anaconda Wire & Cable Co.: Albert H. Leader, manager of sales for Orange and Redwood City mills in California.

Fullman Mfg. Co.: Kenneth B. Schuman Co., Denver, Colo. and Bountiful, Utah, sales representative for Colorado, Utah, Idaho, Wyoming, Montana, New Mexico and El Paso, Texas.

H. K. Porter Co., Inc.: James A. Thomson, Salt Lake City branch manager of National Electric Div.

Owatonna Tool Co.: Howard D. Haugen, district manager, for newly created ten-county territory south of San Francisco.

Briegel Method Tool Co.: H. J. Hoogerwerf, western division sales manager for territory west of Mississippi River.

General Electric Co.: Harry P. Gough, Western regional vice president with headquarters in San Francisco.

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT:
BUSINESS:

"OPPORTUNITIES"

:EQUIPMENT
:USED OR RESALE

—RATES—

UNDISPLAYED

$2.10 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.

Position Wanted ads take one-half of above rate.

Box Numbers in care of our New York, Chicago & San Francisco offices count as one additional line.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

DISPLAYED

Employment Opportunities—$28.10 per inch, subject to Agency Commission.

Equipment & Business Opportunities—$21.00 per inch, not subject to Agency Commission.

An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

Equipment Wanted or For Sale Advertisements acceptable only in Displayed Style.

Send New Ads to Classified Advertising Div. Electrical Construction & Maint. P.O. Box 12, New York 36, N.Y.

ADDRESS BOX NO. REPLIES TO: Box No.
Classified Adv. Div. of this publication.
Send to office nearest you.
NEW YORK 36: P. O. Box 12
CHICAGO 11: 645 N. Michigan Ave.
SAN FRANCISCO 11: 255 California St.

POSITION VACANT

Permanent openings for Resident Engineers experienced in supervision of construction of high-voltage transmission lines. Degree and registration desirable. Excellent opportunity with consulting engineering firm. Please send resume of education, experience and salary requirements to P-7678, Electrical Construction & Maintenance.

SELLING OPPORTUNITY WANTED

Distributor Wants Lines to Sell. Wanted at once all kinds electrical, plumbing and hardware products for new distributor co. in Kentucky and Southern Indiana. Universal Electric Supply, 1001 E. Broadway, Louisville, Ky.

WANTED

Anything within reason that is wanted in the field served by Electrical Construction & Maintenance can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

LEGAL NOTICE

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, JULY 2, 1946 AND JUNE 11, 1960 (74 STAT. 208) SHOWING THE OWNERSHIP, MANAGEMENT AND CIRCULATION

Of ELECTRICAL CONSTRUCTION AND MAINTENANCE published monthly at Albany, New York for October 1, 1961.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Published by McGraw-Hill Publishing Company, Inc., 330 West 42nd St., New York 36, N. Y.; Editor, William T. Stuart, 330 West 42nd St., New York 36, N. Y.; Managing editor, Alice McMullen, 330 West 42nd St., New York 36, N. Y.; Business manager, Wallace C. Carmichael, 330 West 42nd St., New York 36, N. Y.

2. The owner is McGraw-Hill Publishing Company, Inc., 330 West 42nd St., New York 36, N. Y. Stockholders holding 1% or more of stock are: Donald C. McGraw, Elizabeth McGraw Webster, Donald C. McGraw, Jr. & Harold W. McGraw, Jr., Trustees under Indenture of Trust m/b James H. McGraw, dated 1/14/21 as modified; Donald C. McGraw & Harold W. McGraw, Trustees under an Indenture of Trust m/b James H. McGraw, dated 7/1/37 as amended; Donald C. McGraw, individually; Estate of Mildred W. McGraw, Donald C. McGraw and Catharine McGraw Rock, Executors; (all of 330 West 42nd Street, New York 36, N. Y.); Grace W. Mehren, 536 Arenas St., LaJolla, California; Douglass & Co., 140 Broadway, New York, N. Y., Touchstone & Co., c/o Wellington Fund, Inc., Claymont, Delaware.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: 43,592.

McGRAW-HILL PUBLISHING COMPANY, INC.
By JOHN J. COOKE, Vice President & Secretary.

Sworn to and subscribed before me this 18th day of September, 1961.

[SEAL] JANET A. HARTWICK.
(My commission expires March 30, 1963)

CHIEF ELECTRICIAN

IRON MINING

Peru, South America

Maintenance and installation of electrical equipment and facilities at power plant, mine, port and townsite under electrical superintendent.

8 years experience required. Knowledge of Spanish helpful. 2 year contract required with opportunity for long term assignment. Possibility of family housing after 5 months.

Forward brief outline of experience including present rate.

MARCONA MINING CO.—U. S.
141 BATTERY STREET
SAN FRANCISCO 11, CALIFORNIA

Manufacturers Representatives Wanted

Nationally recognized manufacturer of complete line of plastic conduit for above and underground installations is seeking established manufacturers agents calling on the electrical distributor. Choice territories now available. Please write in detail to:

Mr. Nathan Pritcher, Vice President,
Consolidated Pipe Company of America,
1066 Home Avenue, Akron 10, Ohio

SELL US YOUR NEW
USABLE ELECTRIC WIRE & CABLE

Send Us Your Listings
Our Offering Will Follow Immediately

PIERCE WIRE & CABLE CO.
2919 N. Paulina St. Chicago 13, Ill.
EAstgate 7-4777

COMMUNICATION (CONTROL) CABLE: Aprox 45,000 ft. G.E. 18 gge, 10 conductor (5 pair) color coded, neoprene covered 500 & 1,000 ft. sealed reels.

List .45¢ per ft. Our price .15¢ FOB Salt Lake City.

Inside ASCR domestic core wire, zinc impregnated, high tensil.

.0852—294 coils; 51,428 lbs. minimum stress @ 1% extension 170,000 lbs.
ultimate stress 190,000 lbs.

.1261—483 coils; 98,132 lbs. minimum stress 160,000 lbs.
ultimate stress 190,000 lbs.

.1291—1269 coils; 194,741 lbs. minimum stress 160,000 lbs.
ultimate stress 190,000 lbs.

.1443—127 coils; 38,546 lbs. minimum stress 160,000 lbs.
ultimate stress 190,000 lbs.

American Society for Testing Materials, 1916 Race Street, Philadelphia, Pennsylvania, Specifications: Standard weight, zinc coated galvanized steel core wire for all conductors, steel reinforced. ASTM designated B 245-59. Tags marked "Bethlehem Pacific."

Original wholesale cost—18¢ per pound.

Subject to prior sale, our price (while it lasts)—5¢ per pound, F.O.B. Portland Area.

NICE CLEAN STOCK

L. NABUT
2815 S. E. Harrison St. • Portland 14, Oregon
Phones CApitol 7-1717 - BElmont 5-5137

WIRE and CABLE WHEN YOU NEED IT

From Chicago you can get immediate delivery on all types of Electric Cable. Order today. We ship same day.

Send for our latest stock sheet

UNIVERSAL WIRE & CABLE COMPANY
2919 N. Paulina St. Chicago 13, Ill.
Branches: Los Angeles—Houston—Denver

Advertising In This Issue

Accurate Mfg. Co. 8
Ackerman-Johnson Co. 192
Adam Electric Co., Frank 21
• Adjustable Fixture Co. 204
Advance Transformer Co. 14
Allen-Bradley Co. 105, 106
• Allis-Chalmers Mfg. Co. 175, 176
• All-Steel Equipment, Inc., Raco Div. 70
American Biltrite Rubber Co., Boston Woven Hose & Rubber Div. 57
• American Steel & Wire Div., of U. S. Steel 28, 29
American Telephone & Telegraph Co. 37
Amprobe Instrument Corp.
  Amprobe Div. 109
  Cable Tracer Div. 111
• Anaconda Metal Hose 166
Anaconda Wire & Cable Co. 32, 58
Appleton Electric Co. 2
• Arro Expansion Bolt Co. 150
• Arrow Conduit & Fittings Corp. 196
Auth Electric Co., Inc. 26
• Automatic Switch Co. 117

Baker-Roos, Inc. 140
Bell Telephone System 37
• Biddle Co., James G. 195
Black & Decker Mfg. Co., The 141, 143, 145, 147
• Blackhawk Industries 203
• Briegel Method Tool Co. 135
BullDog Electric Products Division I-T-E Circuit Breaker Co. 72, 165
Burndy Corp. 151
Bussmann Mfg. Co. 64, 65

Champion Lamp Works 154, 155
Charles Machine Works, Inc. 203
Christie Electric Corp. 199
• Circle F Mfg. Co. 191
Circle Wire & Cable, a Subsidiary of Cerro Corp. 137
Clark Controller Co., The 157
Clayton Mark & Co. 52
Collyer Insulated Wire Co. 158
• Crouse-Hinds Co. .... Fourth Cover
• Cutler-Hammer, Inc. 18, 19, 138

Day-Brite Lighting, Inc. 68, 69
• Diamond Expansion Bolt Co., Inc. 140
Dodge Corp., F. W. 62
Dow Corning Corp. 4

Eagle Electric Mfg. Co., Inc. 194
Easy-Heat, Inc. 206
Economy Fuse Div., Federal Pacific Electric Co. 130
• Efficiency Electric & Mfg. Co. 200
Electrical Construction & Maintenance 201
Electrical Fittings Corp. 16
Electrical Wholesaling 205
• Electro Compound Co. 202
Erickson Electrical Equipment Co. 190

• Federal Pacific Electric Co. 27
• Fullman Mfg. Co. 188
• Furnas Electric Co. 142

Gedney Electric Co. 179
• General Cable Corp. 112, 113
General Electric Co. 24, 25, 34, 35, 36, 41, 184
  Circuit Protective Devices Dept. 120, 121
  Wiring Device Dept. 50, 51
Globe Co., The 164
Goodrich Chemical Co., B. F. 66
• Graybar Electric Co., Inc. 6
Greenlee Tool Co. 139
Guth Co., Edwin F., The .... Second Cover

Helwig Carbon Products, Inc. 200
Holub Industries, Inc. 198, 199

• Hose-McCann Telephone Co., Inc. 202
• Hubbell Inc., Harvey 134
• Huenefeld Co., The 156

• Ideal Industries, Inc. 131, 187
Ilg Electric Ventilating Co. 122
• International Register Co. 189

Jet Line Products Inc. 174
Johns-Manville, Dutch Brand Division 173
Joy Mfg. Co. 180

Kaiser Aluminum & Chemical Corp. 11, 13, 15, 17
• Keystone Mfg. Co. 183
Kidde Ultrasonic & Detection Alarms Div., Walter Kidde & Co. 162
• Killark Electric Mfg. Co. 168, 169
• Klein & Sons, Mathias 200
Kliegl Brothers 119

Leviton Mfg. Co., Inc. 10
Lightolier, Inc. 44, 45

McGill Mfg. Co., Inc. 136
McGraw-Hill Book Co. 206
Midwest Electric Products Inc. 197
• Minerallac Electric Co. 128
Minnesota Mining & Mfg. Co. 118

National Supply Div., Armco Steel Corp. 67
National Wiring Bureau 181
Norton Door Closer Co., Div. of Yale & Towne Mfg. Co. 163

Onan Div., Studebaker-Packard Corp. 49
• O.Z. Electrical Mfg. Co. 33

Paragon Electric Co., Inc. 144
Pass & Seymour, Inc. 40
Penn Controls, Inc. 108
• Phelps Dodge Copper Products Corp. 46, 47
Pittsburgh Standard Conduit Co. 31
• PLM Products Inc. 193
Pringle Electrical Mfg. Co. 202

• Quadrangle Mfg. Co. 196

Ramset Fastening System 114
Rawlplug Co., Inc., The 159
Revere Electric Mfg. Co. 101
Reynolds Metals Co. 194
Ridge Tool Co., The 148, 149

• Rome Cable Div. of Alcoa 38, 39
Royal Electric Corp. 116

• S & C Electric Co. 42, 43
Sherman Mfg. Co., H. B. 190
• Sierra Electric Corp. 126
Simplex Wire & Cable 152
Smithcraft Corp. 161
Smith-Gates Corp., The 188, 204
• Steel City Electric Co. 61
Square D Co. .... Third Cover, 1, 59
Stampings Inc. 192
Stanley Works, The, Power Tools Div. 110
Stonco Electric Products Co. 185
Sylvania Electric Products Inc. 22, 23, 48, 170, 171
System Analyzer Corp. 204

Thompson Electric Co., The 182
Tomic Sales & Engineering Co. 160

• U.S. Electrical Motors Inc. 197
• U.S. Steel 28, 29

• Van Huffel Tube Corp., Power-Strut Div. 127
Vermeer Mfg. Co. 186
Volkswagen of America, Inc. 103

Wagner Electric Corp. 30, 60
Wakefield Corp., Art Metal Lighting Div. 12
Ward Leonard Electric Co. 172
• Weaver Co., J. A. 129
Westinghouse Electric Corp. 132, 133
Wheeler Reflector Co. 63
White-Rodgers Co. 186
Whitney Blake Co. 146
Wide Lite Corp. 20
Williams Co., A. C. 203
• Wiremold Co. 53, 54, 55, 56

■

CLASSIFIED ADVERTISING

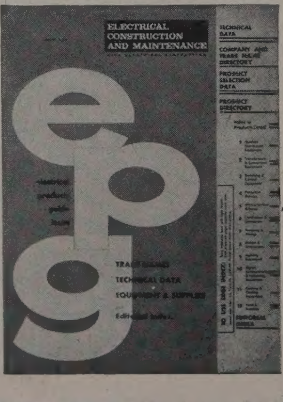
F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES 207

NOTICES
  Legal 207

EQUIPMENT
  (Used or Surplus New)
  For Sale 207

WANTED
  Equipment 207



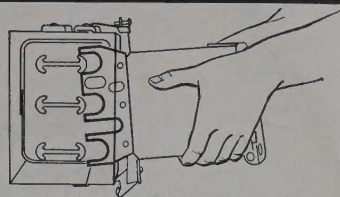
• These manufacturers advertised their products in the ELECTRICAL PRODUCTS GUIDE ISSUE

For more complete information, and application data on their lines, refer to the index of Advertisers in the ELECTRICAL PRODUCTS GUIDE . . . the 13th issue of ELECTRICAL CONSTRUCTION AND MAINTENANCE.

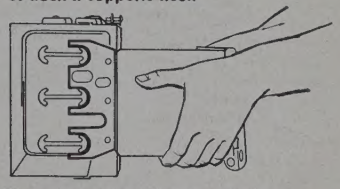
Why SQUARE D ALUMINUM PLUG-IN DUCT?

Because you want a duct that's rugged—built to thrive on heavy duty—*plus*

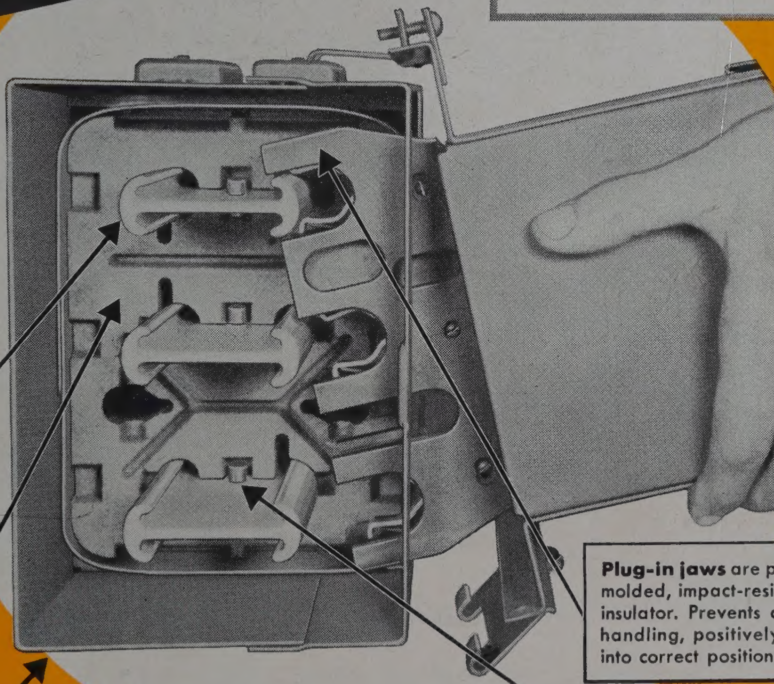
PLUG-IN UNITS GIVE YOU EXCLUSIVE *hook-swing* MOUNTING



Hook clip at top of plug-in unit to top of duct. It supports itself



Then, just swing plug-in unit down until jaws engage bus bars



Hanger mounting (*not shown*) makes installation easy. A universal hanger permits mounting in *any* position. Just suspend and level top portion of hanger, then clip on lower portion. U.L. approved for 10-foot spacing.

I-beam construction of bus bars—a Square D exclusive—provides four times the strength of conventional bus bars. Bars are zinc, copper and silver-plated full length.

Full width bus support provides greater strength on short circuits, freedom from vibration. Also acts as fire stop where duct passes through walls and floors.

Square D duct is totally enclosed for maximum safety—no danger of accidental shorts. Prevents overheating from dust accumulation.

Plug-in jaws are protected by a molded, impact-resisting phenolic insulator. Prevents damage from handling, positively guides unit into correct position.

Steel pins in each bus bar prevent bars from shifting and support them on vertical riser installations.

• With other plug-in duct, it's no easy job to mount the plug-in units. In fact, it takes a lot of real pushing which is neither safe nor easy when you're working on a ladder. With Square D's exclusive *hook-swing* mounting, you just hook the plug-in unit to the top of the duct. Then, simply swing it down and in until the jaws have engaged the bus bars. No awkward pushing required—no unnecessary chances to take. Compare Square D's rugged, heavy-duty construction with any other. It costs no more—why settle for less?

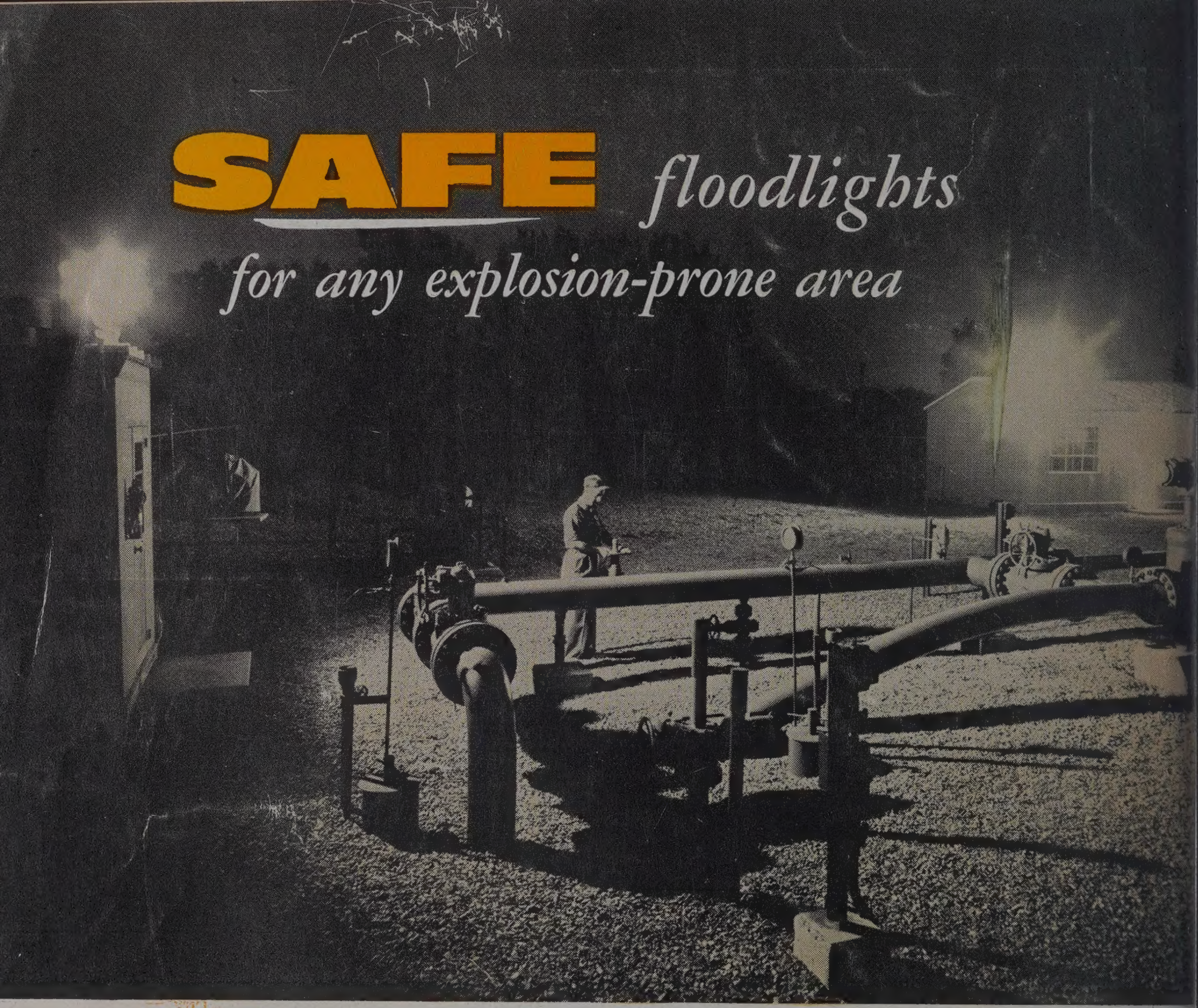
***Write* for Bulletin SD-110. It gives the facts on Square D aluminum plug-in duct. Address Square D Company, Mercer Road, Lexington, Kentucky**

D

SQUARE D COMPANY

wherever electricity is distributed and controlled

SAFE *floodlights*
for any explosion-prone area



These incandescent floodlights are explosion-proof and weather-proof . . . ideal for lighting hazardous areas such as this.

***ADDR-12.** Dust-ignition-proof floodlight. On aluminum dolly to fit over 33-inch manhole.

****RCDE-8.** Explosion-proof incandescent floodlight. Prisms treated to eliminate glare.

*****EVH.** Explosion-proof hand-lamp. Rain-tight, weather-resistant and easy to re-lamp.

What's your illuminating problem?

- Perhaps your problem is dust-ignition-proof floodlighting for dry, dusty, hazardous areas.*
- Possibly you're interested in explosion-proof incandescent floodlights for flush ceiling mounting — something that might be suitable for use in a process control room.**
- Maybe you're looking for rugged, explosion-proof hand lamps — for safe lighting of interiors of large fuel tanks during cleaning or painting operations.***

Whenever and wherever explosion-proof illumination is needed — whether in fluorescent, mercury vapor or incandescent lamps — Crouse-Hinds has a unit to fit your application need.

Check Catalog 320 for floodlights and Catalog 3000 for hand lamps. Or, see your Crouse-Hinds Distributor.

CROUSE HINDS

REG. U. S. PAT. OFF.

MAIN OFFICE: Syracuse, N.Y. **FIELD OFFICES:** Albany, Atlanta, Baton Rouge, Birmingham, Boston, Buffalo, Charlotte, Chicago, Cincinnati, Cleveland, Corpus Christi, Dallas, Denver, Detroit, Houston, Indianapolis, Kansas City, Los Angeles, Milwaukee, Minneapolis, New Orleans, New York, Omaha, Philadelphia, Pittsburgh, Portland, Oregon, St. Louis, St. Paul, Salt Lake City, San Francisco, Seattle, Tampa, Tulsa, Washington. **RESIDENT REPRESENTATIVES:** Baltimore, Md., Meriden, Conn., Reading, Pa., Richmond, Va., Springfield, Mass. **FOREIGN AFFILIATES:** Crouse-Hinds Company of Canada, Ltd., Scarborough, Ont., Crouse-Hinds-Domex, S. A. de C. V. Mexico, D. F. **MANUFACTURING LICENSEE:** Peterco, Sao Paulo, Brazil